Celtic Interconnector Project

Environmental Report supporting the Marine Licence Application

March 2021

Commented [A1]: Cover pages and figures throughout to be updated to omit project Ireland 2040 logo and include RTE and EirGrid logos.

Co-financed by the European Union
Connecting Europe Facility

Tionscadal Éireann
Project Ireland
2040

EIRGRID

Report for

EirGrid plc and Réseau de Transport d’Électricité

Main contributors

Laura Gatdula
Jennifer Wilson
Hannah Nelson
Brian O’Keeffe
Alistair Billington
Rachael Mills

Issued by

Jennifer Wilson
....

Approved by

Alistair Billington
....

Wood

Doc Ref. 43171-WOOD-XX-XX-RP-OM-0013_B_P01

Copyright and non-disclosure notice

Third party disclaimer

Management systems

This document has been produced by Wood Group UK Limited in full compliance with our management systems, which have been certified to ISO 9001, ISO 14001 and ISO 45001 by Lloyd's Register.

Document revisions

No.	Details	Date
1	Draft for client review	January 2021
2	Incorporation of client comments	February 2021

Table of Contents

Glossary

AA	Appropriate Assessment
AIS	Automatic Identification System
BAS	Burial Assessment Study
CBRA	Cable Burial Risk Assessment
CEF	Connecting Europe Facility
CPCS	Cable Protection Complementary Study
DEFRA	Department for Environment Food and Rural Affairs
DOL	Depth of Lowering
EC	European Commission
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EPC	Engineering Procurement Construction
EQS	Environmental Quality Standard
ESAS	European Seabirds at Sea
EU	European Union
FLO	Fisheries Liaison Officer
GES	Good Environmental Status
HVDC	High Voltage Direct Current
HRA	Habitats Regulations Assessment
ICES	International Council for the Exploration of the Seas
IUCN	International Union for the Conservation of Nature
JER	Joint Environmental Report
JNCC	Joint Nature Conservation Committee
KP	Kilometre Point
MCAA 2009	Marine and Coastal Access Act
MCMS	Marine Case Management System
MCZ	Marine Conservation Zone
MFE	Mass Flow Excavator
MHWS	Mean High Water Springs

MMO	Marine Management Organisation
MW	Megawatt
NCA	National Competent Authority
NSCOG	Northern Seas Offshore Grid
OGA	Oil and Gas Authority
PCI	Project of Common Interest
PEXA	Practice and Exercise Areas
RTE	Réseau de Transport d'Electricité
SAC	Special Area of Conservation
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SFWD	Shellfish Waters Directive
SI	Statutory Instrument
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TEN-E Regulation	European Union Regulation No. 347/2013 on guidelines for Trans-European Network for Energy
TOC	Total Organic Carbon
TOM	Total Organic Matter
TSO	Transmission System Operator
TSS	Traffic Separation Scheme
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordnance
VMS	Vessel Monitoring Service
WFD	Water Framework Directive
ZoI	Zone of Influence

1 Introduction

1.1 Project Overview

The Celtic Interconnector Project ('the Project') is a proposed electrical link between Ireland and France. The Project will enable the import and export of electricity between Ireland and France and will be the first direct energy link between the two countries, running from the south coast of Ireland to the north-west coast of France. It is being jointly developed by EirGrid plc and Réseau de Transport d'Électricité (RTE), the Transmission System Operators (TSOs) in Ireland and France respectively.

The Project is designated as a European Project of Common Interest (PCI) under the provisions of European Union Regulation No. 347/2013 on guidelines for Trans-European Network for Energy (TEN-E Regulation).

The Celtic Interconnector subsea cable route is approximately 497 kilometres (km) long with 35km in Ireland's Territorial Waters, 116km in the Irish Exclusive Economic Zone (EEZ), 211km in the United Kingdom's (UK) EEZ, 87km in the French EEZ, and 48km in French Territorial Waters (all distances stated are approximate). The cable route does not enter the Territorial Waters of the UK. Onshore cables and associated infrastructure are also proposed in Ireland and France; however, for the purposes of this Environmental Report (ER), these are not considered further herein.

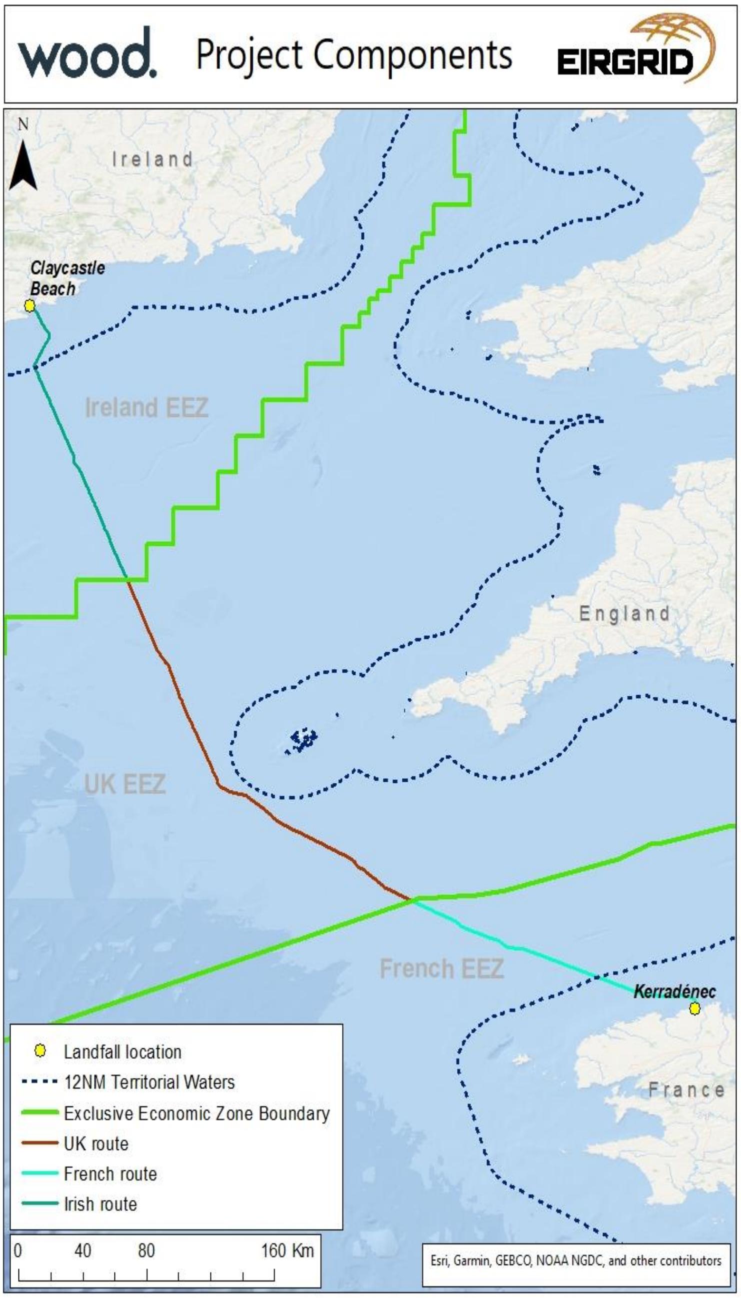
An overview of the Celtic Interconnector Project is shown in Figure 1.1. It presents the entire offshore element of the proposed subsea route, from the Irish landfall point at Claycastle Beach in County Cork, through Irish, UK and French waters, and beyond to the French landfall point at Kerradénec in Finistère.

The need for the Project is driven by the objectives to:

- support Europe's transition to the Energy Union;
- increase competition in the electricity market by applying downward pressure on the cost of electricity to the benefit of consumers in Ireland, France, and Europe;
- enhance the security of supply for both Irish and French electricity consumers;
- support Europe's transition to a low carbon energy future by increasing the market available for renewable electricity and supporting the development of the renewable energy sector; and
- provide Ireland's only energy connection to an EU Member State following the UK's departure from the EU.

The Project has been in development since 2011 and is currently in the Detailed Design and Consents (DDC) phase (including the detailed design, Engineering Procurement Construction (EPC) procurement and consenting workstreams). The submission of formal consenting applications in the three jurisdictions is planned to be complete by mid-2021, with overall consent expected to be achieved in 2022. The construction phase is expected to start in 2022, with the interconnector to become operational in late 2026 or early 2027.

Figure 1.1 Overview of Celtic Interconnector across all jurisdictions



1.2 Context and Purpose of this Report

This purpose of this report is to support a Marine Licence application for the section of the subsea cable and associated external cable protection within the UK EEZ.

The Marine and Coastal Access Act 2009 (as amended) ('MCAA 2009) provides the framework for the licensing of certain activities proposed to be carried out within the UK EEZ. The MCAA 2009 establishes the Marine Management Organisation (MMO) as the body responsible for issuing and administering marine licences. Under Part 4, Article 66(1) of the MCAA 2009, a marine licence is required by the Celtic Interconnector Project for the installation and maintenance of cable protection within the UK EEZ, as it is a licensable marine activity to:

"Deposit any substance or object within the UK marine licensing area, either in the sea or on or under the seabed, from – (a) any vehicle, vessel, aircraft or marine structure".

Article 10(4)(a) of the TEN-E Regulation requires the competent authority to identify the following in relation to the Project's PCI application:

"*The scope of material and level of detail of information to be submitted by the project promoter, as part of the application file, to apply for the comprehensive decision".*

On 10 September 2020, the MMO issued a letter to the Project promoters setting out the information required under Article 10(4)(a) of the TEN-E Regulation. A copy of this letter is provided in Appendix B.

The letter provided in Appendix B requires that the Marine Licence application to the MMO must include an ER that demonstrates the outcome of assessments relating to the offshore elements of the Project. This report is the ER for the Celtic Interconnector Project, submitted to the MMO in support of the marine licence application for the Project. The ER will inform decisions made by the MMO regarding the marine licence. The marine licence application has additional requirements that are detailed in Chapter 3 of this report.

This ER is structured as follows:

Commented [A2]: The content of the UK ER will be reviewed upon receipt of the MMO's comments on the Scoping Report, and in light of the ongoing UK consultation exercise.

- Chapter 2: An overview of the European and UK legislation and policy and the consenting regime applicable to the Project in the UK EEZ;
- Chapter 3: An overview of the anticipated structure and content of the marine licence application file, and an overview of the PCI application process;
- Chapter 4: A description of the approach to consultation, and a summary of the consultation undertaken to date and the forthcoming consultation yet to be held that will inform the marine licence application and supporting assessments
- Chapter 5: A description of the Project comprising the marine components in the UK EEZ;
- Chapter **Error! Reference source not found.**: A description of the design a lternatives that have been considered in the evolution of the Project;
- Chapter 6: A description of the methodology for the assessment to ensure the significance of the impacts identified is fully assessed;

- Chapter 8: An overview of the existing physical, human and biological receiving environment that has the potential to be impacted by the Project including the identification of the likely significant impacts of the Project, and those impacts that are likely to be non-significant and are therefore proposed to be excluded from the ER that will support the marine licence application;
- Chapters **Error! Reference source not found.** - 21: Technical chapters that assess t he potential likely significant effects of the Project on marine receptor groups, accompanied by a description of any mitigation measures that are embedded into the Project design and monitoring where appropriate to avoid, or reduce the potential to the Project to adversely affect the marine environment; and
- Chapter 22: Conclusions and recommendations.

1.3 The Project as a non-EIA Development

Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of certain public and private projects on the environment ('the EIA Directive') (as amended) requires that the types of project listed in Annex I of the Directive, must undergo an Environmental Impact Assessment (EIA). Member States have the responsibility for deciding whether Annex II projects should also undergo EIA with relevant thresholds set in national legislation.

In the UK, the EIA Directive is transposed into national law for projects within the marine environment by The Marine Works (Environmental Impact Assessment) Regulations 2007, as amended by the Marine Works (Environmental Impact Assessment) Regulations 2017 ('the 2017 Marine Works Regulations'). These regulations outline the type of projects that require an EIA and set out the process to be followed for a marine works application to assess the effects of the proposed development on the environment.

The MMO, in its Statutory function as Competent Authority for EIA in respect of the proposed development, advised the Project promoters during a pre-application consultation call on 23 July 2020 that the nature and extent of the Celtic Interconnector Project within its jurisdiction is not a type of development that is subject to EIA, and that therefore it would not be screened in for EIA, either by agreement or by determination.

Subsequently, the proposed development was the subject of a formal EIA screening determination, whereby the Project Promoters submitted a formal Screening request to the MMO on 03 November 2020 in line with the requirements of Schedule 2 of the 2017 Marine Works Regulations. The MMO confirmed in a Screening request response, dated 17 December 2020 (Appendix A), that the proposed works in the UK EEZ do not constitute EIA development having regard to the legislation in force, and therefore the wider context of the EIA Directive and the 2017 Marine Works Regulations are not applicable to the Project in the UK jurisdiction.

While the proposed development being submitted to the MMO is not a type of development requiring formal EIA, it is still of imperative importance that adequate environmental (and other) information is before the MMO in order to facilitate it in making a robust decision in respect of the Marine Licence application. Therefore, this ER contains a comprehensive environmental appraisal of topics and other relevant material.

1.3.1 Project Status in Irish and French Jurisdictions

There is no mandatory legislative requirement for EIA for the marine components of the Project in Ireland. However, it was advised to the Project promoters by the Foreshore Unit of the Department of Housing, Local Government and Heritage (DHLGH) during pre-application consultation in April 2019 and February 2020, that it would be beneficial for an EIA to be undertaken for the Project. The Project promoters have therefore elected to prepare and submit an ER in respect of the marine components of the Project within the Irish jurisdiction.

In addition, an EIAR is also being submitted to An Bord Pleanála Strategic Infrastructure (SI) Division – the relevant Competent Authority - in respect of the Irish Onshore element of the overall Celtic Interconnector Project, notwithstanding that this element is also not a type of development that requires to be subject to mandatory EIA.

The transposition of the EIA Directive into French law requires that an EIA is mandatory for the onshore and offshore elements of the Project in France and French waters. RTE is undertaking EIA under the French consenting regime for the onshore and offshore elements of the Project in France.

By this approach, the Project promoters are seeking to ensure a whole-project approach to environmental assessment, due to the extensive and transboundary nature of the Project.

In summary, a multi-volume application submission that will cover the onshore and offshore elements of the Project in Ireland is being submitted to the PCI Unit of An Bord Pleanála (the Competent Authority for PCI in Ireland), in line with the TEN-E Regulation. This will include EIARs for Ireland Onshore, Ireland Offshore, French Onshore and French Offshore environments, with the latter two submitted to [xxxxx]. It will also, for information and understanding, include this ER in support of the UK Marine Licence application, and a Joint Environmental Report (JER) that covers onshore and offshore works throughout all jurisdictions.

Commented [A3]: Confirmation of the consenting authorities will be provided in the final Application File.

Relevant portions of this multi-volume submission will be submitted to An Bord Pleanála SI Division as the regulatory body for terrestrial planning affairs in Ireland, and to the Foreshore Unit of the DHLGH as the regulator for foreshore consents and marine planning in Irish waters.

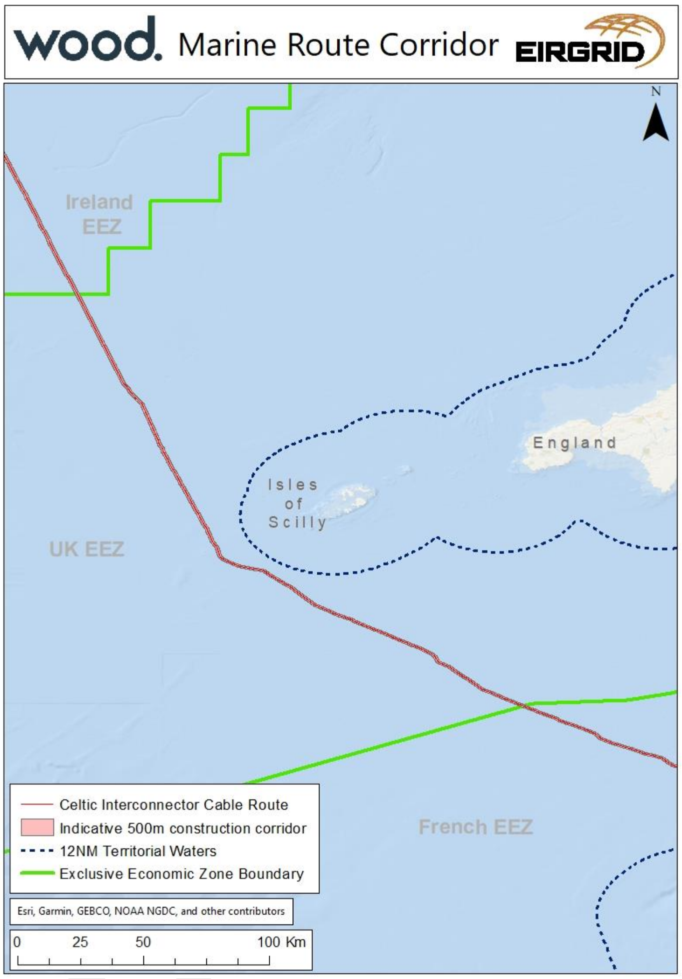
1.4 Study Area

The marine components of the Project in the UK jurisdiction fall entirely within the UK Exclusive Economic Zone (EEZ). The proposed subsea cable route does not enter the 12 nautical miles (nm) of UK Territorial Waters.

The indicative marine route corridor in the UK EEZ is shown in Figure **Error! No text of specified style in document.**.1. Within the UK EEZ, the cable route has a length of 211km. The cable route lies within an indicative 500 metres (m) wide corridor, so this area of seabed and water column is included in the study area for the majority of environmental topics addressed in this Report.

Certain environmental topics require the consideration of a wider area of the marine environment and these areas are specified in Chapters **Error! Reference source not found.** to 21.

Figure Error! No text of specified style in document.**.1** **Indicative Marine Route Corridor**



2 Relevant Policy and Legislation

Commented [A4]: Chapter to be updated to reflect most up to date position regarding Brexit related legislation and policy, prior to submission of final Application File.

This chapter sets out the planning policies and legislation that support the development of the subsea element of the overall Project within the UK EEZ, and with which the Project must comply to secure consent for installation.

2.1 European Context

2.1.1 EU Regulation of Transboundary Projects

The UK is signatory to the Convention on Environmental Impact Assessment in a Transboundary Context (the Espoo Convention), which was adopted in 1991. Signatory States are obliged to assess the environmental impact of certain activities at an early stage of planning. Projects that are likely to have a significant adverse environmental impact across boundaries or jurisdictions are required to engage in transboundary consultation.

The 2013 EC Guidance on the Application of the Environmental Impact Assessment Procedure for Large-scale Transboundary Projects states:

"For large-scale transboundary projects, the developer must comply with the requirements of the national EIA requirements of each country in which the project will be implemented. The developer should prepare individual national EIA reports and a joint environmental report that covers the whole project and assesses its overall effects, in particular cumulative, and significant adverse transboundary effects".

As also noted in Chapter 1, as responsible developers, the Project promoters seek to implement a whole-project approach and to undertake a robust assessment of the entire Project equally in all jurisdictions. The French JER, the voluntary EIARs for the Irish onshore and Irish offshore, and this ER have therefore been developed having regard to the provisions of the Espoo Convention as well as established guidance and regulation on best-practice for the assessment of impacts of projects on the receiving environment.

2.1.2 TEN-E Regulation

The European Union has identified the Celtic Interconnector as a Project of Common Interest (PCI) for the Northern Seas Offshore Grid (NSCOG) priority corridor in October 2013 under the TEN-E Regulation. The Celtic Interconnector Project is seen as a key contributor to the European Energy Transition for Ireland, France and Europe and has retained its PCI designation during subsequent reviews on a bi-annual basis and most recently on the fourth list of PCI projects published by the European Commission on 31 October 2019. The TEN-E Regulation seeks to modernise and expand Europe's energy infrastructure and to interconnect networks across borders to meet the Union's core energy policy objectives of competitiveness, sustainability, and security of supply.

The TEN-E Regulation requires that each Member State assign a single co-ordinating authority, also known as the National Competent Authority (NCA), as being responsible for facilitating and coordinating the permit granting process for projects within that Member State, and to co-ordinate with other NCA's on PCI projects. In the United Kingdom, the NCA is the MMO. The TEN-E Regulation requires that PCI projects be given 'priority status' at a national level to ensure rapid administrative treatment.

Under the Regulation, a PCI Project is required to make a “draft application file” available to consultees and the public for comment. Following receipt of the file, the NCA will identify whether information is missing and inform the Project Promoters of any omissions. The Schedule of Permit Granting Process provides that the NCA will confirm that the “final application file” can be submitted within 3 months of receipt of the “draft application file” or the submission of any missing information identified.

2.1.3 Maritime Spatial Planning Directive

In the UK, the MCAA 2009 provides a marine planning system along with provisions for the improvement of marine conservation and management. Matters of relevance to the UK section of the Celtic Interconnector Project are summarised in Section 2.3 of this Environmental Report (ER).

In 2014, the EC published Directive 2014/89/EU of the European parliament and of the council of 23 July 2014 (the Maritime Spatial Planning Directive, or MSP Directive), which establishes a framework for maritime spatial planning across the EU member states. The MSP Directive came into force in September 2014 requiring European Member States to develop Maritime Spatial Plans by 31 March 2021. It sets out the fundamental elements that must be reflected in Maritime Spatial Plans including the promotion of the coexistence of relevant uses and activities.

The draft South West Offshore Marine Plan was published on 10 January 2020. The plan focusses on enhancing and protecting the marine environment and achieving sustainable economic growth, whilst respecting local communities both within and near the marine plan areas. It is the relevant marine plan for consideration by the MMO in relation to the UK elements of the Project. Further detail on the draft South West Offshore Marine Plan is provided in Section 2.3.

2.1.4 European Union (Withdrawal Agreement) Act 2020

A number of UK laws are determined by a range of EU Directives, regulations and agreements which are outlined in this Chapter. The UK left the EU on 31 January 2020 under terms set out in the European Union (Withdrawal Agreement) Act 2020 (‘the Withdrawal Act’). The Withdrawal Act established a transition period that ran until 31 December 2020. This transition period saw the UK being treated for most purposes as if it were still an EU member state with most EU law (including as amended or supplemented) remaining applicable to the UK. The Withdrawal Act retains existing EU-derived law (which includes the EIA Regulations and other relevant environmental legislation) within national law.

At the time of writing, the exact nature of amendments to UK legislation pertaining to the marine licencing regime and wider environmental assessments that originate from EU law is uncertain. However, any changes to relevant policy and legislation will be updated and considered as the marine licence application process proceeds towards submission.

2.1.5 EIA Directive

The EIA Directive, (as amended) requires that a competent authority must carry out an assessment of the effects of a proposed project on the environment prior to a development consent being granted. As noted in Section 1.3, and as advised by the MMO, the proposed works in the UK EEZ are not a type of EIA development under Annex I or Annex II of the EIA Directive or the requirements of the 2017 Marine Works Regulations. The Project Promoter has received a negative screening response from the MMO in this regard. Therefore, there is no mandatory requirement for EIA in the UK under the EIA Directive.

2.1.6 Habitats Directive and Wild Birds Directive

European Commission (EC) Directive 92/43/EC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) and EC Council Directive 2009/147/EC on the conservation of wild birds (Birds Directive) establish the EU-wide Natura 2000 network of protected areas.

The Natura 2000 network consists of Special Areas of Conservation (SACs) designated under the Habitats Directive, and Special Protection Areas (SPAs) designated under the Birds Directive. SPAs and SACs are designated by the individual member states. A key requirement of the Habitats Directive is that the effects of any plan or project, alone, or in combination with other plans or projects, on the Natura 2000 site network, should be assessed before any decision is made to allow that plan or project to proceed. This process is known as Appropriate Assessment (AA). The AA process is transposed into UK law through the Conservation (Natural Habitats) Regulations 1994 (as amended). If a project is likely to have significant effects on any Natura 2000 site either alone or in combination with other plans or projects (or if such effects cannot be excluded on the basis of objective evidence), it must undergo an AA by the competent authority. In the context of AA, the competent authority cannot consent the plan / project without first having determined that it will not have an adverse effect on the integrity of the Natura 2000 site(s) concerned, either alone, or in combination with other plans or projects.

A Habitats Regulations Assessment (HRA) Screening Report has been produced for the UK marine components of the Celtic Interconnector Project to establish whether an AA is required. This is provided in Volume 11: Habitat Regulations Assessment. Where a HRA Screening Report concludes that significant effects are certain, likely or cannot be excluded on the basis of objective information, a HRA Stage 2 Report is required to be prepared by the applicant. The HRA will inform the AA carried out by the competent authority prior to the determination of the application. In this case, the HRA would be prepared in consultation with the MMO as well as with relevant statutory nature conservation bodies including Natural England and the Joint Nature Conservation Committee (JNCC).

2.2 Other relevant EU Directives

2.2.1 Marine Strategy Framework Directive

Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (the Marine Strategy Framework Directive, or 'MSFD') seeks to ensure Good Environmental Status (GES) within designated water bodies with the MSFD covering waters beyond 1 nautical mile (NM) from the coast (mean low water mark).

Annex I of the MSFD identifies 11 qualitative descriptors for GES. These are listed in Table Error! No text of specified style in document.**.1**, along with signposting to the relevant chapter where the descriptor has been addressed in the ER. Volume 10C presents further detail on the MSFD and how the Project has been assessed against it.

Table Error! No text of specified style in document.**.1 Signposting to consideration of MSFD Descriptors in the ER**

MSFD Descriptor	**MSFD description of what the environment will look like when GES has been achieved.**	**Chapter in ER where the MSFD Descriptor has been considered**
Descriptor 1	Biodiversity is maintained	Chapter 14: Biodiversity
Descriptor 2	Non-indigenous species do not adversely alter the ecosystem	Chapter 14: Biodiversity Chapter 19: Shipping and Navigation
Descriptor 3	The population of commercial fish species is healthy	Chapter 14: Biodiversity Chapter 20: Commercial Fisheries
Descriptor 4	Elements of food webs ensure long-term abundance and reproduction	Chapter 14: Biodiversity
Descriptor 5	Eutrophication is minimised	Chapter 13: Marine water quality
Descriptor 6	The sea floor integrity ensures functioning of the ecosystem	Chapter 11: Marine sediment quality Chapter 12: Marine physical processes
Descriptor 7	Permanent alteration of hydrographical conditions does not adversely affect the ecosystem	Chapter 12: Marine physical processes Chapter 14: Biodiversity
Descriptor 8	Concentrations of contaminants give no effects	Chapter 13: Marine water quality Chapter 14: Biodiversity
Descriptor 9	Contaminants in seafood are below safe levels	Chapter 20: Commercial Fisheries
Descriptor 10	Marine litter does not cause harm	Chapter 13: Marine water quality
Descriptor 11	Introduction of energy (including underwater noise) does not adversely affect the ecosystem	Chapter **Error! Reference source not found.**: Noise and vibration

MSFD Descriptor	MSFD description of what the environment will look like when GES has been achieved.	Chapter in ER where the MSFD Descriptor has been considered
		Chapter 14: Biodiversity

The MSFD has been transposed into UK law through the Marine Strategy Regulations 2010 (SI 2010/1627). The UK Marine Strategy Regulations 2010 require action to be taken to achieve or maintain GES in the UK's seas. The UK Government's updated Marine Strategy Part One describes the environmental status that was current in 2018 and sets objectives and targets for achieving GES in line with the MSFD up to 2024. The UK Marine Strategy is geographically administered via a series of sub-regions, with the Celtic Interconnector located within MSFD Sub-region: Celtic Seas. The Celtic Interconnector has been screened against the UK MSFD targets for the Celtic seas sub-region to assess any potential risk that those targets may be compromised because of the installation, operation or decommissioning of the Project.

2.2.2 Water Framework Directive

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (the Water Framework Directive, or 'WFD') sets out Environmental Quality Standards (EQSs) that are used to assess the risk of chemical pollutant impacts on water quality to the health of aquatic plants and animals in freshwater, estuarine and coastal waters out to 12 nautical miles (nm). The Directive has been transposed into UK law through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 In accordance with the Regulations, proposals that have the potential to impact 'waterbodies' as designated by the WFD are required to demonstrate that actions would not result in a deterioration in 'ecological status'. There is a requirement for objectives to be set to facilitate the achievement of Good Ecological Status (GES), Good Ecological Potential (GEP) and Good Chemical Status (GCS). The WFD applies to all bodies of water within 1nm from the coastline in the UK for GES and out to 12nm for GCS. It is notable that the jurisdiction of the MSFD and WFD overlap between the coast as the 12nm limit in relation to WFD GCS.

The Celtic Interconnector Project subsea cable route and associated works within the UK EEZ are located beyond the 12nm limit of UK Territorial Waters and therefore beyond the boundary for a WFD screening requirement.

Chapter 11 and Chapter 13 consider the potential for effects on marine sediment quality and marine water quality arising as a result of the Project to be detectable in WFD waterbodies. These chapters conclude that, given the distance from the installation area, coastal WFD waterbodies will not be affected. An MSFD screening has been undertaken that will address MSFD Descriptors that are closely comparable to those concerning GCS in the WFD, it is the view of the Project promoters that a separate WFD screening for the UK EEZ is not applicable or beneficial to the marine licence application process.

2.2.3 Shellfish Waters Directive

Directive 2006/113/EC of the European Parliament and of the Council of 12 December 2006 on the quality required of shellfish waters (the Shellfish Waters Directive, or 'SFWD') is applicable at designated shellfisheries. The nearest designated shellfish waters to the Project are 99.7km from the Celtic Interconnector cable route (Helford River). The Project does not intersect with any designated shellfisheries. Given the distance between the Project and the nearest designated shellfish waters, no impacts to designated shellfish waters are anticipated. The requirements of the SFWD are therefore not considered further.

2.3 UK Legislation and Policy

2.3.1 Marine and Coastal Access Act 2009

The Marine and Coastal Access Act 2009 (MCAA 2009) provides a marine planning system along with provisions for the improvement of marine conservation and management with the MMO as the competent authority.

The UK Marine Policy Statement (MPS) 2011 was prepared and adopted for the purposes of section 44 of the MCAA 2009. The MPS provides the policy framework for preparing Marine Plans and for making decisions affecting the marine environment. It ensures that:

"*marine resources are used in a sustainable way in line with the high-level marine objectives*" **Error! Bookmark not defined.**.

A marine plan:

- sets out priorities and directions for future development within the plan area;
- informs sustainable use of marine resources; and
- helps marine users understand the best locations for their activities, including where new developments may be appropriate.

As previously noted in Section 0, Part 4 of the MCAA 2009 provides that a marine licence is required for the installation of cable protection in relation to the Celtic Interconnector Project. When deciding on a marine licence application, the MMO considers the Marine Policy Statement (MPS) 2011, relevant marine plans, policies and all relevant matters including the need to:

- protect the environment;
- protect human health; and
- prevent interference with legitimate uses of the sea.

To enable the MMO to make their decision, the applicant must provide sufficient information regarding the proposed development, including detailed description of the works, and an assessment of any potentially significant effects which may arise as a result. The requirements specified by the MMO are presented in Chapter 3.

Additional Project activities within the UK EEZ include cable route surveys and seabed preparation works, cable laying, and post-burial surveys (further details in Chapter 5). Under Section 81(2) of the MCAA 2009, the installation of an international electricity cable is exempt from requiring a marine licence within the offshore marine plan area (beyond 12nm from shore).

2.3.2 Draft South West Marine Plan

The route of the subsea element of the Project crosses the area covered by the South West Offshore Marine Plan. The south west offshore marine plan area extends from the 12nm limit out to the seaward limit of the Exclusive Economic Zone (EEZ).

The draft South West Offshore Marine Plan was published on 10 January 2020 and focusses on enhancing and protecting the marine environment and achieving sustainable economic growth, whilst respecting local communities both within and near the marine plan area. It is the relevant marine plan for consideration by the MMO in relation to the UK elements of the Project.

The draft South West Offshore Marine Plan recognises the importance of submarine cabling to the growth and sustainability of telecommunications, offshore wind farms and electricity transmission. Cable related policies in the draft plan support and encourage cable burial and promote co-existence with other users of the south west marine plan areas but emphasise that, where burial is not achievable, decisions should take account of protection measures for the cable that may be proposed by the applicant.

3 PCI Application and Marine Licence Application Content

3.1 Overview

For the Project in the UK, the Project promoters must submit a draft PCI application via the MMO's Marine Case Management System (MCMS).

Under Article 10(4)(a) of the TEN-E Regulation, the MMO has stipulated the scope of material and level of detail of information to be submitted by the Project Promoters as part of the PCI application in a letter dated 10 September 2020 (Appendix B). The PCI requirements stipulated by the MMO include the submission of a draft marine licence application. The content of these parts of the submission as well as other important documents that support the PCI and marine licence applications are described below. A high-level description of the PCI application submission procedure is also provided for context.

3.2 Draft PCI Application File

The required contents of the draft PCI application file submitted to the MMO for the Project in the UK are outlined in Appendix B.

3.3 Marine Licence Application Content

The marine licence application must also be submitted via the MMO's Marine Case Management System (MCMS). The fields that must be completed by the applicant relate to the following:

- Application type;
- Project details including project title, background, and a programme of works;
- Information concerning any related consents or applications that may have been made in relation to the Project within the UK or other jurisdictions;
- Contact details for a named person within the applicant organisation;
- Information concerning the approach of the Project to sustainable development. This could include the project's alignment with relevant national plans and policies and EU Directives, an identification of the environmental, social and economic drivers for the Project, any particular cumulative effect concerns, and the rationale for optioneering decisions that may have led to the selection of a preferred design option;
- Provision of an Environmental Report or similar that reports upon any environmental assessments of the Project;
- Statements to confirm that the Project has considered the potential for effects on European sites via HRA, Marine Conservation Zones (MCZ), and Sites of Special Scientific Interest (SSSI);
- A statement to confirm that the Project has considered the requirements of the Water Framework Directive;
- Information concerning consultation and advertising;
- Site location data including coordinates and ESRI shapefiles;

- Cost of the Project seaward of MHWS, understood to reflect the anticipated cost of installation within all jurisdictions, and excluding maintenance costs; and
- Permissions relating to data use by the MMO.

3.4 PCI Application Procedure

Commented [A5]: Reference to relevant subsection of the TEN-E Regs to be added here, prior to submission of final Application File.

3.4.1 Confirmation of Draft Application File Content

In accordance with Article 10 (4)(2) of the TEN-E Regulation, if there are any documents missing that have been requested by the MMO or if any documents are lacking sufficient detail, the MMO will notify the Project Promoters within one month of the submission of the Draft Application File and will send an application update request via a letter.

In the event that any of the information set out in Section 3.2 is missing, the MMO will issue a letter to the Project Promoters summarising the missing information and request that this is provided via the appropriate method. This will be provided by the MMO within one month of the submission of the draft application file, if required.

3.4.2 Confirmation of Final Application File

Within three months of the submission of the Draft Application File or the submission of all the missing information, the Project Promoters must submit the Final Application File via CD to the MMO.

Once the MMO receives the Final Application File, the MMO will confirm the formal start of the 18-month statutory permit granting procedure under the TEN-E Regulation.

3.4.3 Comprehensive Decision

Once a marine licence and full consents have been granted, the MMO will issue a letter to the Project Promoters stating that the statutory permit granting procedure has been completed and that these comprise the comprehensive decision for the purposes of the TEN-E Regulation.

Commented [A6]: A complete list of the consents required will be listed here.

4 Consultation Approach

As a PCI project, the Celtic Interconnector project is obliged to undertake extensive public and stakeholder participation via communication, engagement and consultation in the UK, Ireland, and France. The Project Promoters are responsible for managing and conducting engagement activities in the UK. The approach to consultation and engagement is presented below, both from a PCI perspective, and to support the marine licence application and supporting Environmental Report (ER).

4.1 Concept of Public Participation

In accordance with the requirements of Article 9(3) and Annex VI of the TEN-E Regulation, the project promoters prepared and submitted a Concept for Public Participation (CPP) relating to the Celtic Interconnector project to the MMO in March 2020.

Having regard to the global public health situation at the time caused by the Coronavirus pandemic, the project promoters sought approval from the MMO to adapt their consultation methods by putting in place remote information and consultation mechanisms. To complement this and set out the more detailed plans of how this consultation process would be executed, the project promoters also prepared a Communication Strategy Document which they submitted to the MMO in May 2020.

The MMO fully appreciated this requirement and following receipt of feedback from the MMO in relation to same, the project promoters subsequently submitted an updated version of the CPP to the MMO in June 2020 incorporating a revised Communication Strategy Document. The updated CPP was formally accepted by the MMO in June 2020 and a copy remains available on the project's website: www.celticinterconnector.eu.

The accepted CPP set out the information sharing and public participation measures that the project promoters proposed to undertake in the UK in relation to the project in order to ensure stakeholder and general public participation in the consultation process.

4.2 Public consultation in the UK

A summary of the public consultation carried out in the UK is provided separately to the ER in the Consultation Report: Report on consultation activities related to the project.

As agreed within the CPP, A targeted Project Information Leaflet for UK Stakeholders was released in May 2020, to inform an online-consultation process which ran from 16 June to 13 July 2020, including a number of webinars with the regulators, their advisors and key stakeholders. Questions were raised through this process, with the findings incorporated as appropriate into ongoing application documentation.

A webinar event was held on 9 July 2020 which was attended by some of the key consultees including the JNCC, NFFO, The Crown Estate, the Royal Yachting Association and Trinity House. Topics discussed at this event included rock protection and cable burial depth, impacts on and communication the fishing industry, mitigation against cable exposure and UXO surveys. A summary of the issues discussed with these stakeholders is included in Table 4.1.

4.2.1 Consultation activities supporting the marine licence application

A summary of the consultation activities undertaken to support the marine licence application will be presented in a separate UK Consultation Report.

Consultation activities initially focused largely on design evolution to ensure that feedback from the public, regulatory and non-regulatory organisations could influence the final design and location wherever possible. Once the design evolution work was complete and in preparation for the marine licence application for the offshore components of the Project within the UK EEZ, an informal scoping exercise was undertaken, including development of a technical note that set out the proposed content and scope of the marine licence application and supporting ER. It described the data proposed to be used and the approach to the necessary technical assessments. It also provided a rationale for scoping out certain topics or receptor groups where an initial review has identified that impacts to these are unlikely (see Chapter 8).

The technical note provided a consideration of alternative routing and engineering options, and scoped the likely significant effects of the Project on the marine environment. Its purpose was to inform the content of the ER and the marine licence application. This document was submitted to the MMO for its consideration, review, and pre-application advice in January 2021.

There has been ongoing engagement with the MMO, which has included meetings from early 2020 focused on the particular requirements of the marine licence application and supporting documentation.

Given the widespread COVID-19 related restrictions in 2020 and extending into 2021, all stakeholder meetings to inform the ER have been carried out as video online meetings (with telephone dial in option).

The Scoping technical note included a list of stakeholders who would be issued a consultation letter and invited to engage and provide comments on the Project. These stakeholders are set out in Table 4-1 below.

The MMO confirmed their intention to consult some of these stakeholders themselves as part of the voluntary scoping process (depicted with *), and therefore consultation letters were only issued to remaining stakeholders. These letters were issued on 19 February 2021 and comments are due back by 18 March 2021.

Commented [A7]: The Report will be updated to take account of the responses received.

These will also be reported in a UK consultation report.

Table 4.1 Key stakeholders and proposed focus for engagement discussion

Consultees Name	Engagement focus
MMO*	General information about the project – both in terms of application progress, stakeholder engagement activities and approach to the marine licence application.
JNCC*	Feedback on topics of conservation interest, including marine ecology and HRA, and engagement activities to

Consultees Name	Engagement focus
Natural England **Cefas*** **Environment Agency** **Local Wildlife Trusts** **Natural Resources Wales**	resolve any issues prior to submission of the marine licence application.
Historic England*	Feedback on topics of marine heritage interest, and engagement activities to resolve any issues prior to submission of the marine licence application.
Maritime & Coastguard Agency* **Trinity House*** **Chamber of Shipping** **Royal Yachting Association** **Department for Transport** **UK Major Ports Group** **British Ports Association** **Ministry of Defence** **St Mary's Harbour (Isles of Scilly) Port Authority** **The Crown Estate***	Feedback on topics of navigational interest (commercial and recreational), and engagement activities to resolve any issues prior to submission of the marine licence application.
NFFO* **Isles of Scilly Inshore Fisheries and Conservation Authority** **South West Inshore Fisheries and Conservation Authority**	Feedback on potential interactions with commercial fisheries, and engagement activities to resolve any issues prior to submission of the marine licence application.
Various NGOs: **Sea Watch Foundation**	Feedback on potential issues arising from the installation of external cable protection, and engagement activities to

Consultees Name	Engagement focus
Ocean Conservation Trust	resolve such issues prior to submission of the marine licence application.

A summary of the responses received and confirmation on how the responses were taken into account will be reported separately in the UK Consultation Report.

5 Project Description

5.1 Introduction and Project Overview

The Celtic Interconnector is a joint project being developed by EirGrid, the electricity Transmission System Operator (TSO) in Ireland, and its French counterpart, RTE (Réseau de Transport d'Électricité) and is being supported by the European Union's Connecting Europe Facility (CEF). It is also a European Union Project of Common Interest (PCI), first designated in 2013 and renewed every two years since, and a designated e-Highway 2050 project.

The project involves the construction of an electrical circuit between Ireland and France using High Voltage Direct Current (HVDC) technology, the global standard for the transfer of electricity over long distances using underground technology. The interconnector would have a capacity of 700 MW (equivalent to the power used by approximately 450,000 homes) and measures approximately 575km in length. The longest spatial element of the Celtic Interconnector would be the submarine circuit which would measure approximately 497km out of the total 575km. The interconnector would form a link between County Cork on the south coast of Ireland and the coast of Brittany in North West France (Nord-Finistère).

The main elements of the interconnector consist of:

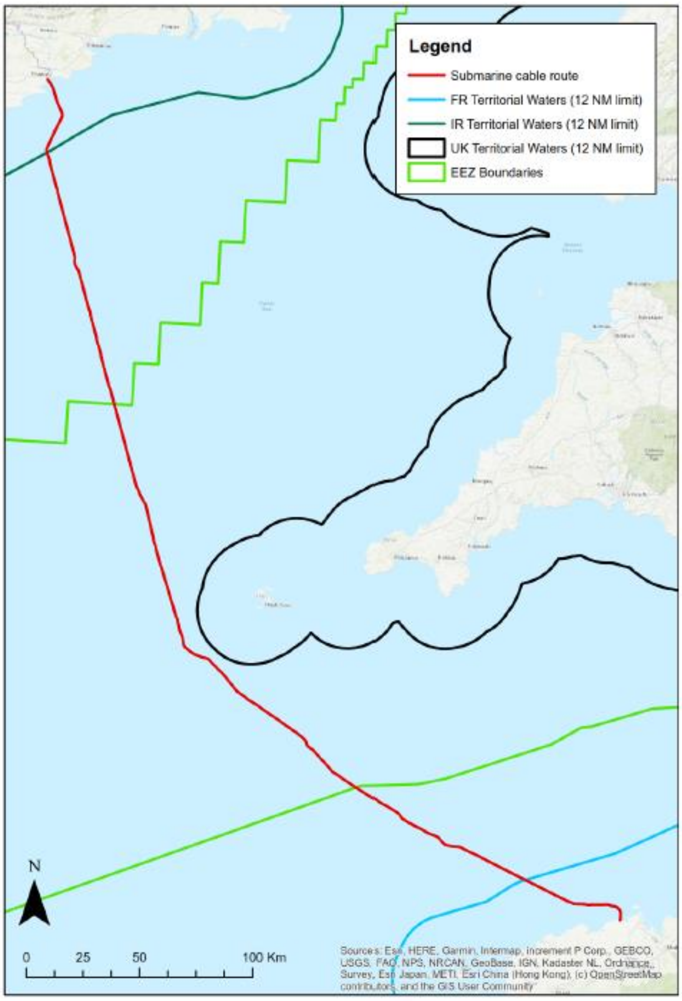
- A submarine circuit, approximately 497km in length placed on or beneath the seabed between France and Ireland. The submarine circuit will pass though the territorial waters of Ireland and France and through the Exclusive Economic Zones (EEZs) of Ireland, the UK and France, as shown in **Error! Reference source not found.**5.1.
- The cable route within the UK EEZ is approximately 211km long. It passes approximately 30km to the west of the Isles of Scilly and approximately 75km to the west of Land's End on the UK mainland.
- The cable route does not enter the Territorial Waters of the UK.
- Landfall points in France and Ireland where the submarine circuit comes onshore, with associated onshore infrastructure, and connection points to an existing substation on the transmission grids of France and Ireland. NB: These elements are noted here for context but are not considered further in this Report.
- A fibre optic link would also be laid along the entire cable route for operational control, communication and telemetry purposes.

This project description focuses on the section of the Project within the UK EEZ, and specifically on the installation of cable protection as this is the activity that requires a marine licence and is described in Section 5.2. Additional activities and works within the UK EEZ that are proposed within the context of the Project but that do not require a marine licence are also described in Section 5.2.

Detailed descriptions of the Project's route in Irish and French waters, and the associated onshore elements, can be found in the Joint Environmental Report covering the project in all three jurisdictions, accompanying this Environmental Report (ER).

A burial assessment study (BAS) has been completed for the Project in accordance with industry guidance recommendations, that is the UK Carbon Trust's Cable Burial Risk Assessment (CBRA). This study identified the target depths of lowering (DOL) of the cable into the seabed along the cable route. The target DOL will vary depending upon seabed geology and also with the variable risk profile that exists from anchor penetration and fishing gear, etc.

Figure 5.1 Celtic Interconnector Submarine Cable Route Map



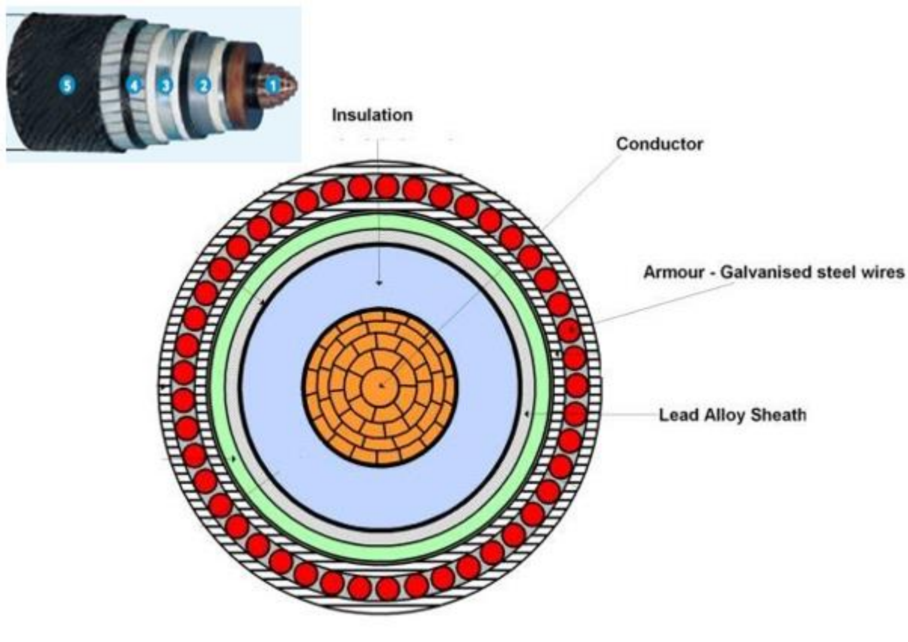
5.2 Submarine Cable

The Celtic Interconnector project within the UK EEZ almost entirely comprises the laying of a submarine cable package. The submarine package is comprised of a pair of electrical cables as well as a fibre optic link. The purpose of the fibre optic link is to enable communication and operational control between both converter stations – one in Ireland and one in France. It is anticipated that each electrical cable will have a diameter of between 100mm and 200mm and the fibre optic link will have a dimension of approximately 20mm.

Each electrical cable will use HVDC technology between the two converter stations. HVDC is the global standard for the transfer of electricity over long distances.

Error! Reference source not found. provides an illustration of a typical cross section for e ach of the electrical cables. The submarine cables will be comprised of a number of elements including a central metallic conductor made of copper or aluminium that is surrounded by insulation. A lead alloy sheath will be located outside of the insulation layer; this in turn will be surrounded by armouring that is made of galvanised steel wires. This will all be contained within an external protection layer. The operational life of the electrical cables is expected to be at least 40 years.

Figure 5.2 Typical Cross-section of Submarine Cable



5.2.1 Cable Route

UK Territorial Waters

The cable route does not enter the Territorial Waters of the UK.

UK Exclusive Economic Zone

The cable route through the UK EEZ is approximately 211km in length (KP 151.0 to KP 362.0).

The sediment coverage for first 34km (KP 151.0 to KP 185.0) and last 57km (KP 305.0 to KP 362.0) of this cable route is considered good, consisting of a combination of dense sand, gravel and high strength clay. Installation in these areas is envisaged using standard burial tools (plough or a mechanical trenching tool).

There is approximately 120km of the marine route (KP 185.0 to KP 305.0) to the west of the Isles of Scilly that has more challenging strata, consisting of chalk. Sections of this route may pose a challenge to cable burial using standard burial tools and may require the use of specialist rock cutting tools for trenching.

Cable burial in sediment would result in temporary disruption of the seabed during trenching operations, whereas rock trenching would result in a permanent deformation of the seabed. The anticipated target depth of lowering varies between 0.8m and 2.5m and is based on seabed geology and the variable risk profile that exists from anchor penetration and fishing gear in the vicinity. It is envisaged that the trench would be back-filled with the spoil either during the installation process or by means of natural backfill from the surrounding sediment.

The footprint of the cable installation on the seabed is anticipated to be approximately 5.0m wide. However, this may increase to approximately 15.0m during seabed preparation and cable installation works due to the size of the equipment deployed for these activities (i.e. boulder / cable plough, mechanical trencher, etc.). It is anticipated that seabed preparation activities will be completed in the weeks or months prior to the main cable installation works and will involve boulder clearance and potential for sand wave sweeping along some sections of the cable route. Where remedial rock protection is required the footprint will increase to approximately 15m-30m.

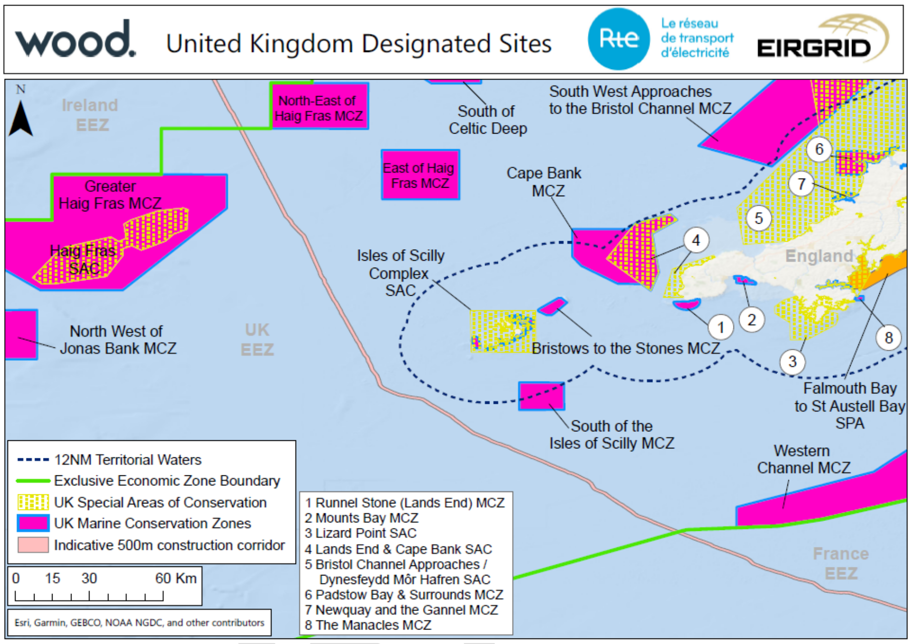
The metocean conditions along this section of the cable route can be divided in two halves;

- The first half (northern section of the cable in UK EEZ to the west of the UK mainland) is characterised by weak currents and tides, high exposure to swell and strong wind field; and
- The second half (southern section of the cable in UK EEZ to the west of the English Channel) is characterised by medium currents and tides, high exposure to swell, and medium wind field. Tides and currents increase quickly towards the south.

Close to the Isles of Scilly the probability of superficial sediment mobility induced by currents is high (70 - 90%). This is due to an acceleration of currents near the islands. The sediment thickness that can be impacted by mobility is generally less than 1m but can reach 1.5 to 2.5m in some very localised areas.

Sand waves have been identified at a number of locations within the cable corridor (~12) and a number of route sections may potentially be impacted by sand wave migration by the year 2065. The cable will be buried to the required Depth of Lowering below the seabed datum and therefore sandwave migration will not impact the operation of the cable. The route does not intersect any Marine Conservation Zones or European sites designated for nature conservation as shown in Figure 5.3:

Figure 5.3 UK Exclusive Economic Zone – Cable Route and UK Designated Sites

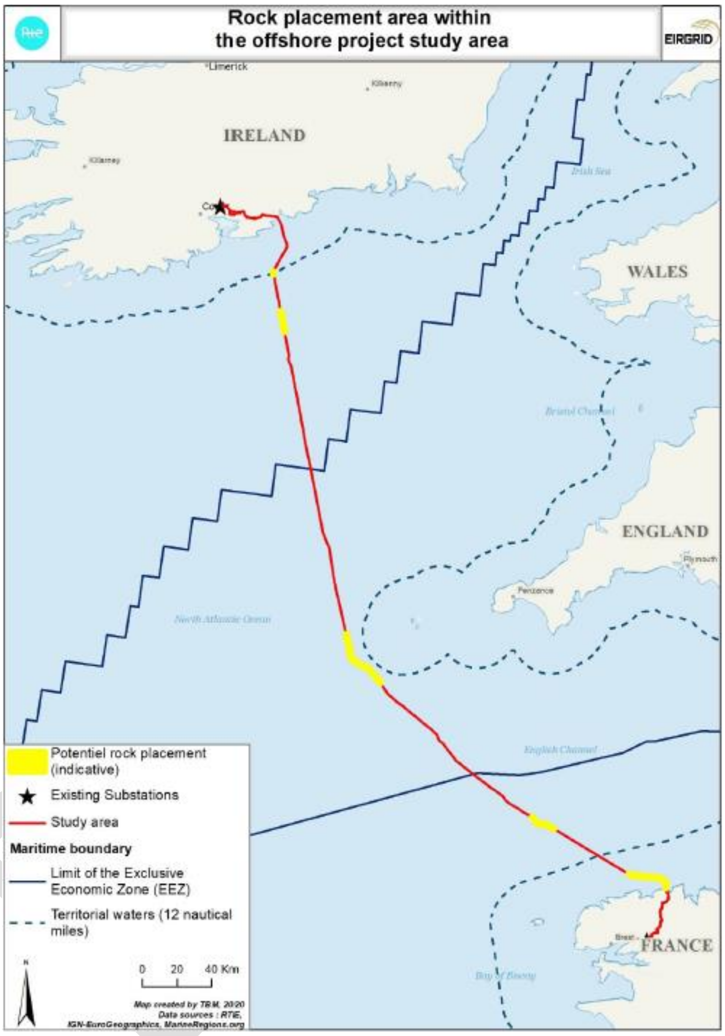


Rock Protection Worst Case Scenario

The installation of the marine cable protection will require a marine licence. Rock placement as a means of primary cable protection is not envisaged along the cable route in the UK EEZ. Some secondary rock protection may be required where the target DOL is not fully achieved. The level of secondary rock protection shall be minimised as much as possible through the best endeavours of the installation contractor to achieve the required level of protection through burial.

The linear extent of potential rock protection in the UK EEZ is between 0km and 80km in the worst case, or 0t to 270t. Figure 5.4 shows the indicative locations of the main offshore work sites of the Celtic Interconnector Project where it is currently anticipated that external protection may be required, i.e. the locations of proposed rock placement areas. This map is purely indicative and may be subject to further change.

Figure 5.4 **Indicative Locations of offshore rock placement areas**



5.2.2 Marine Construction Works

The installation of the submarine cables will typically follow a sequence similar to that described herein. Certain activities, specifically the installation of cable protection will require a marine licence.

- Unexploded Ordnance (UXO) intervention campaign (if required);
- Boulder clearance;
- Sandwave pre-sweeping (where necessary);

Commented [A8]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

- Pre-lay grapnel runs;
- Construction of infrastructure crossings;
- Pre-lay route survey;
- Cable lay;
- Post-lay survey;
- Cable burial;
- External / Secondary protection (where necessary, marine licence required); and
- Post-burial survey

Survey, Route Engineering and Finalisation

The installation contractor will survey and have responsibility for the finalisation of the marine route. The contractor will carry out route engineering to optimise conditions for the specific installation tools / techniques to be used. This will include finalisation of extents of areas for boulder clearance, sandwave pre-sweeping, and for deployment of the different burial tools.

UXO Clearance

It is not anticipated that UXO clearance will be necessary in the UK EEZ. Magnetometer surveys undertaken to date have not identified a high potential for UXO targets along the cable route in UK EEZ. Pre-construction surveys of the cable route will further determine the presence of any UXO. In the unlikely event that UXO are found, they will be either avoided, removed or detonated in situ under licence held by the EPC contractor, and informed by relevant environmental assessments. A full UXO survey campaign will be performed prior to cable installation.

Commented [A9]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

Boulder Clearance

Certain portions of the cable route are populated by boulders in varying concentrations. In the first instance, the recommended approach would always be to avoid problematic targets or areas by route engineering which has been completed to a great level of detail. Nevertheless, unavoidable boulders are a common challenge to submarine cable projects in and around the Islands of the North Atlantic and Channel area.

Boulder clearance (where required) may be attempted in three ways:

1. The boulders may be pre-cleared using a purpose-built plough, or individually using a grab, in advance of cable lay / burial operations.
2. The boulders may be dealt with on an as-encountered basis. In this case the options available would be limited to use of a grab or (if possible) micro-routing of the cable.
3. The concentration of boulders may be deemed prohibitive and the decision may be taken to use secondary protection only (e.g. rock placement).

The range of options for boulder mitigation is illustrated on against a spectrum of increasing boulder density as shown in Figure 5.5, with examples of clearing equipment presented in Figure 5.6.

Figure 5.5 Boulder Options Summary

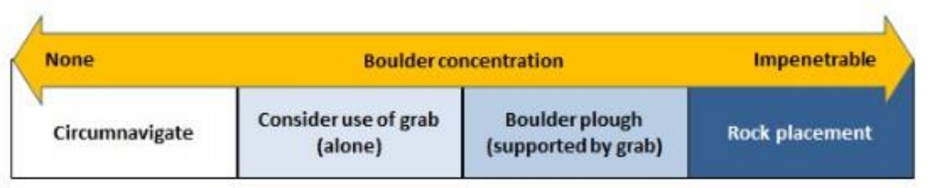


Figure 5.6 Ecosse SCAR Plough (Left) & Boulder Grab (Right)

5.2.3 Sandwave Sweeping

The bedforms encountered along the cable route are generally isolated features rather than repeated waves, suggesting that they may be relatively stable. Nevertheless, avoidance is essential to facilitate installation and to minimise risk of cable exposure from snagging by an anchor or fishing equipment as this could result in it becoming displaced, damaged or broken.

In the event that bedforms must be crossed, pre-sweeping is generally considered the optimum approach, which could require the use of a mass flow excavator (MFE), as shown in Figure 5.7. This is likely to be required in UK EEZ from approximately KP 340.0 to KP 354.0, which corresponds to the most south-easterly 14km section of cable route within the UK EEZ before the cable route enters the French EEZ.

Figure 5.7 Mass flow excavator (James Fisher Marine)

Pre-Lay Grapnel Run

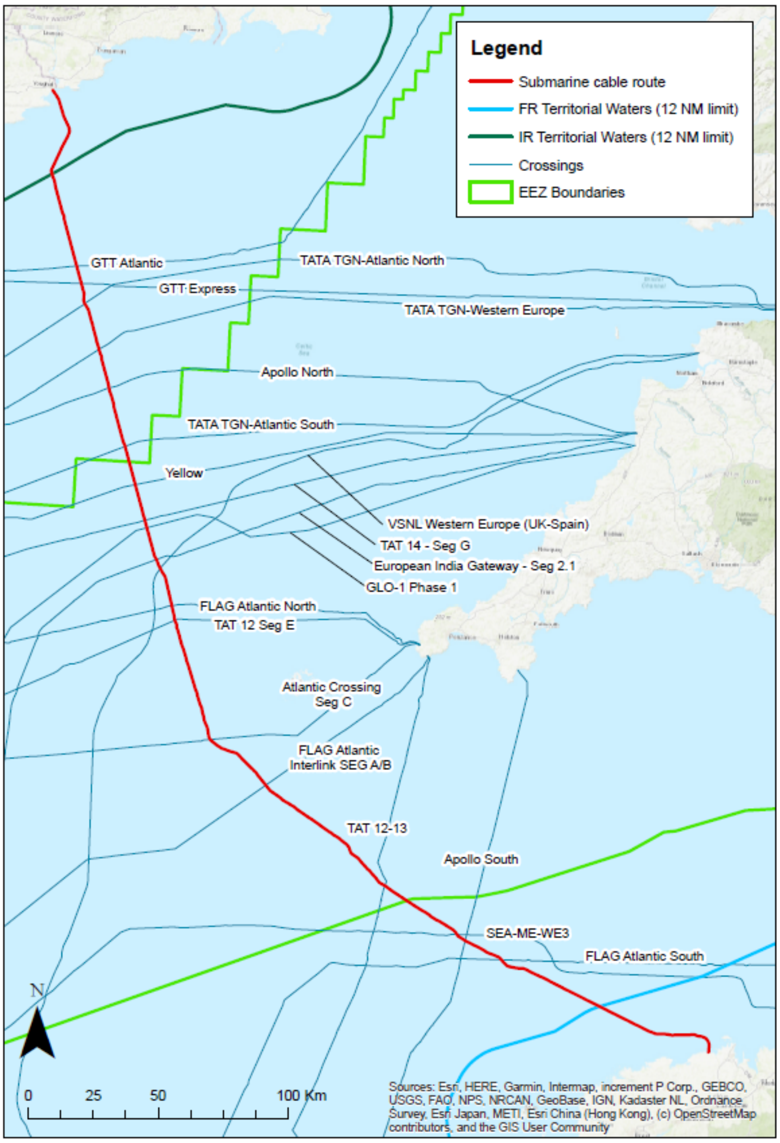
Pre-lay grapnel runs will be required along the cable route on the seabed to ensure debris, for example redundant cables, fishing gear, discarded ropes, are cleared in advance of cable lay. The cable footprint on the seabed is anticipated to be approximately 5.0m wide. However, this may increase to approximately 15.0m during seabed preparation and cable installation works due to the size of the equipment deployed for these activities.

Construction of Infrastructure Crossings

Rock placement or concrete mattresses / sleepers will be utilised for the construction of third-party infrastructure crossings. Concrete mattresses are prefabricated and consist of a number of concrete block sections connected by polypropylene rope.

There are 19 in-service telecommunication cable crossings identified along the cable route to date, 10 of which are within the UK EEZ, as shown in Figure 5.8. There is one additional third party cable planned to be installed ahead of the Celtic Interconnector which will require to be crossed. Each cable crossing will require a specific crossing design to be agreed with each asset owner.

Figure 5.8 Cable crossings along the route of the Celtic Interconnector

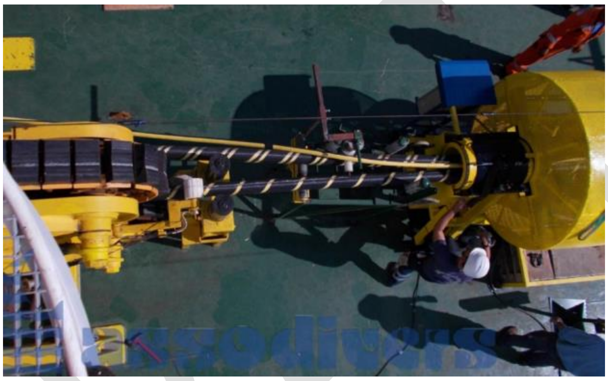


Cable Lay & Burial

It is anticipated that the submarine cable will be installed in a bundled configuration, with the fibre optic cable(s) also installed within the bundle. Bundling the cables (as shown in **Error! Reference source not found.**) ensures the installation footprint is minimised (reducing boulder sweeping and potential rock volumes).

There is a wide range of vessels available on the market with the capacity to install cables of the dimensions proposed for the Celtic Interconnector. A number of high capacity cable laying vessels have been built in recent years, specifically designed for large cable projects and typically with twin carousels.

Figure 5.9 Power cables and fibre optic cable going through bundle machine (Asso Divers)



The burial technique will vary depending on geology of the seabed. The sediment coverage for first 34km (KP 151.0 to KP 185.0) and last 57km (KP 305.0 to KP 362.0) of this cable route is considered good, consisting of a combination of dense sand, gravel and high strength clay. Installation in these areas is envisaged using standard burial tools (plough or a mechanical trenching tool).

There is approximately 120km of the marine route (KP 185.0 to KP 305.0) to the west of the Isles of Scilly that has more challenging strata, consisting of chalk. Sections of this route may pose a challenge to cable burial using standard burial tools and may require the use of specialist rock cutting tools for trenching.

Cable burial in sediment would result in temporary disruption of the seabed during trenching operations, whereas rock trenching would result in a permanent deformation of the seabed. The anticipated target depth of lowering varies between 0.8 m and 2.5 m and is based on seabed geology and the variable risk profile that exists from anchor penetration and fishing gear in the vicinity. It is envisaged that the trench would be back-filled with the spoil either during the installation process or by means of natural backfill from the surrounding sediment.

Cable burial is the preferred method of cable protection in so far as the underlying seabed geological conditions allow for.

Cable burial tools fall broadly into three main categories:

1. Plough;
2. Jetter; and
3. Mechanical Trencher.

Ploughs (such as that presented in Figure) may be of displacement and non-displacement varieties. Displacement ploughs are used to dig trenches in the sediment in advance of cable installation. A back-filling pass may be employed post lay to close the trench back over the cable. A non-displacement plough works by passing the cable through the plough share to a level below the seabed with minimum disturbance and leaving an effectively closed trench in its wake

Jetting tools (such as that presented in Figure) work by fluidisation and are therefore generally used in soft sea beds such as clays and silts, with small grain sizes. They perform less well in sands and gravels, and particularly cobbles. Such conditions may also prevent passage of the jetting swords through the seabed. Water jetting may be employed as a standalone method or form part of a hybrid solution. Jetting (only) tools work by injecting high-pressure water into the soil to fluidise it and allow the cable to sink into the seabed. They are consequently generally used for fairly soft, penetrative soils.

The category of tool most commonly used for the granular sediments that cover the vast majority of the cable route is the mechanical or hybrid trenching machine (**Error! Reference source not found.**). Such tools are controlled remotely and run on tracked wheels along the seabed, burying the cable beneath the body of the machine.

Specialist heavy duty equipment such as rock cutters may be employed if ground conditions are too difficult to penetrate using 'standard burial tools'.

A burial assessment study (BAS) has been completed for the project in accordance with industry guidance recommendations, i.e. Cable Burial Risk Assessment (CBRA). This study identified the target depths of lowering (DOL) of the cable into the seabed along the cable route. The target DOL will vary depending upon seabed geology and also with the variable risk profile that exists from anchor penetration and fishing gear etc.

Figure 5.10 Prysmian Plough

Figure 5.11 Nexans CAPJET Jetter

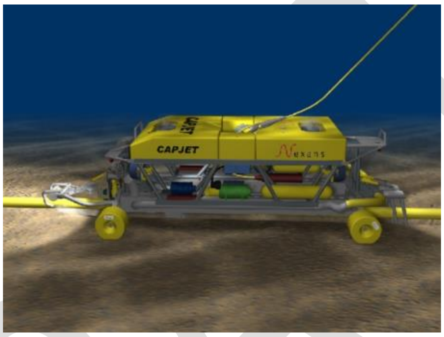


Figure 5.12 ASSO Trencher

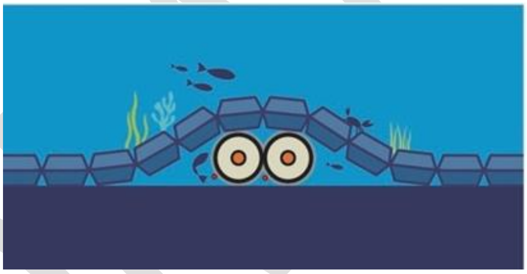
Installation of External Cable Protection

External cable protection is required to protect the cable in areas where trenching is not deemed feasible (i.e. due to the presence of hard rock or seabed obstacles that could not be cleared), deemed ‘primary’ cable protection, or as a remedial ‘secondary’ cable protection measure if the target DOL cannot be achieved. Rock placement as a means of primary cable protection is not envisaged along this section of the cable route. However, it is likely that some secondary rock protection may be required where the target DOL is not fully achieved.

The primary external protection approach is through rock placement (Figure). However, a number of other options could be considered, notably concrete mattressing (**Error! Reference source not found.**); these however are only economic over short distances and are considered a more localised solution (for example at infrastructure crossings). Rock placement would be sourced from certified quarries, with well-developed infrastructure.

Figure 5.13 Rock Placement

Figure 5.14 Concrete Mattressing

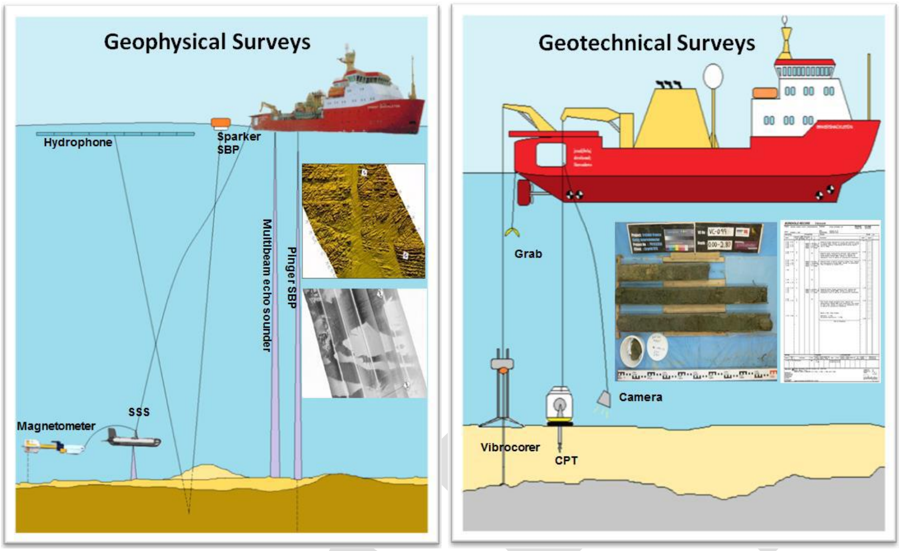


5.2.4 Construction Traffic

Offshore

The offshore works involve a number of vessels and activities as discussed in Section 5.2.2. The first vessel will be a survey vessel comprising approximately 15 persons on board (POB). This may on occasion require access to UK Ports, particularly in adverse weather conditions.

Figure 5.15 Typical Survey Vessels and Activities



The preparatory works shall be carried out in advance of cable lay with a vessel of approx. 30-40 POB. This may on occasion require access to UK Ports, particularly in adverse weather conditions.

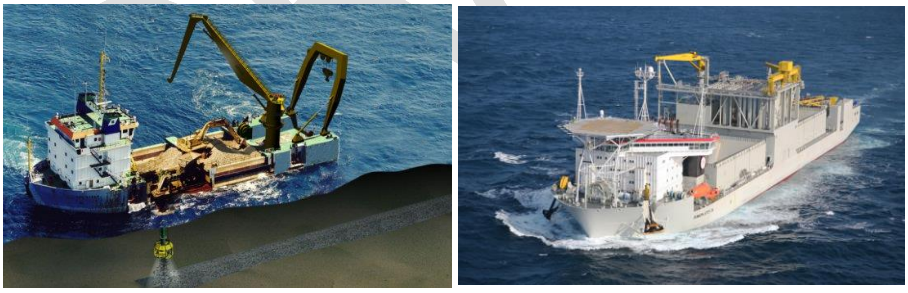
Figure 5.16 Typical Seabed Preparation Vessels

The cable lay vessel (approx. 90 POB) shall arrive at site fully laden with all equipment required to perform the installation activity.

Figure 5.17 Typical Cable lay Vessels

A rock trenching vessel and rock placement vessel may be required in the UK EEZ. If these vessels are required, the rock trenching vessel, with approximately 30-40 POB, will perform post-lay burial activities; the rock placement vessel, with approximately 30-40 POB will deploy secondary rock protection.

Figure 5.18 Typical Rock Placement Vessel



There will be a number of general supply vessels required during the course of construction and also a rock supply vessel if rock placement is required.

5.2.5 Outline Construction Schedule and Timing of Works

Subject to the grant of statutory approvals and all necessary consents, it is programmed that installation of the offshore route will commence in 2024, for it to become fully operational by 2027.

Offshore Works

The offshore works involve a number of vessels and activities as discussed in Section 5.2.2. The first activity will be the pre-lay survey expected to last 40 days in UK EEZ and be performed well in advance of the main construction activity.

The main construction activity shall entail initial preparatory works which shall be carried out in advance of cable lay for approximately 40 days in the UK EEZ.

Offshore cable installation is envisaged using standard burial tools (plough or a mechanical trenching tool). There is approximately 120km of the marine route in the UK EEZ (KP 185.0 to KP 305.0) that has more challenging strata, consisting of underling chalk. Sections of this route may pose a challenge to cable burial using standard burial tools and may require the use of specialist rock cutting tools for trenching. The overall schedule for cable lay and burial in UK EEZ excluding weather or mechanical damage stand by is 139 days.

A rock placement vessel, only if required in the UK EEZ, will follow cable installation and be required in UK EEZ for between 0 days and approximately 50 days.

The durations of the works provided are indicative only and based on 24/7 operations. Safety requirements for the installation operations / procedures and weather condition may ultimately dictate the final programme.

5.2.6 Decommissioning

The Celtic Interconnector is strategic infrastructure of National and European importance. While not currently envisaged to occur, it will be decommissioned in the scenario that it ceases operation. However, the operational life of the submarine cables, and other equipment, is expected to be at least 40 years from the start of operation. It is currently anticipated that the cable and associated external cable protection will be left in-situ where this is deemed environmentally acceptable; this may require a level of long-term monitoring and maintenance.. If replaced, the submarine cables will be removed for recycling in accordance with the relevant waste management regulations in place when decommissioning takes place.

Where decommissioning works are required to remove infrastructure, these will be the subject of future consent applications as appropriate, to include relevant environmental assessments.

6 Consideration of Alternatives

6.1 Alternative Cable Routes

6.1.1 Cable Route Development

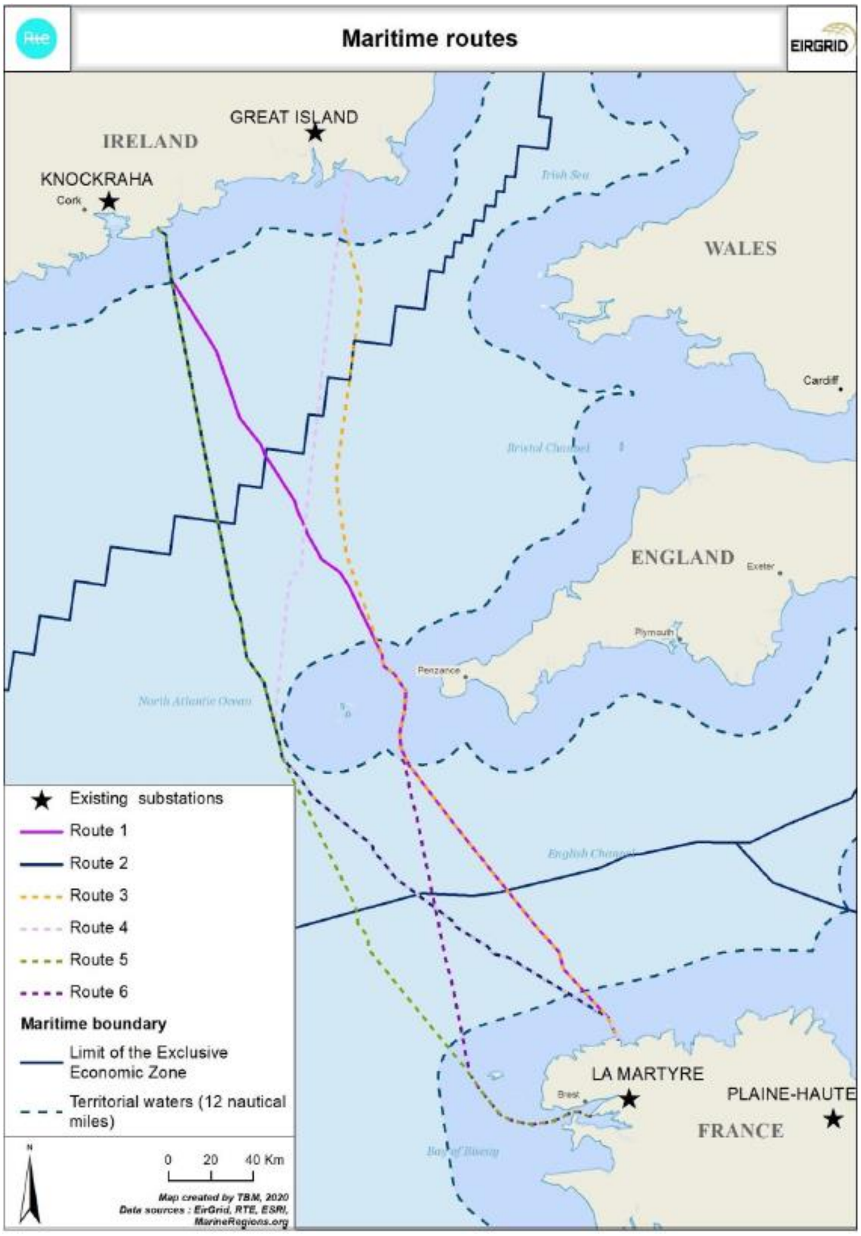
The focus of this Consideration of Alternatives is alternative cable routes.

The history of the development of the Project route in terms of information gathered and decisions taken is follows:

- **Late 2013 to early 2014**: Early desktop studies identified six main corridors for the route "Trunk" from the Cork or Waterford / Wexford coasts to the Côte des Légendes or the Rade de Brest coasts. Nominal points were chosen offshore of the landfall area to facilitate comparison of the six main trunk options as shown in Figure 3.1.
- The main route options were as follows:
- Route 1: Cork Coast to Côte des Légendes inside UK Territorial Waters.
- Route 2: Cork Coast to Côte des Légendes outside UK Territorial Waters.
- Route 3: Waterford / Wexford Coast to Côte des Légendes inside UK Territorial Waters
- Route 4: Waterford / Wexford Coast to Côte des Légendes outside UK Territorial Waters.
- Route 5: Cork Coast to Rade de Brest outside UK Territorial Waters.
- Route 6: Waterford / Wexford Coast to Rade de Brest inside UK Territorial Waters.
- These six route options were assessed in detail and then ranked based on a range of different constraints such as environmental, technical, third-party and commercial constraints. Of the six routes identified, two were initially recommended for further investigation, namely, Route 1 and Route 2.
- These routes were considered the favoured options due to a combination of the level and type of constraints present along their routes and commercial factors such as their overall length. Route 1 was the shortest route and the second least constrained route. Route 2 was the third shortest route and the least constrained route.
- Overall, and although marginally greater in length, the best performing option identified was Route 2 (the least constrained) and this was chosen for detailed marine survey in 2014 / 2015. Further information can be found in the Step 2 Report (Appendix x).

Commented [A10]: Reference to be added.

Figure 6.1 Locations of the 6 offshore routes studied and feasible connection substations

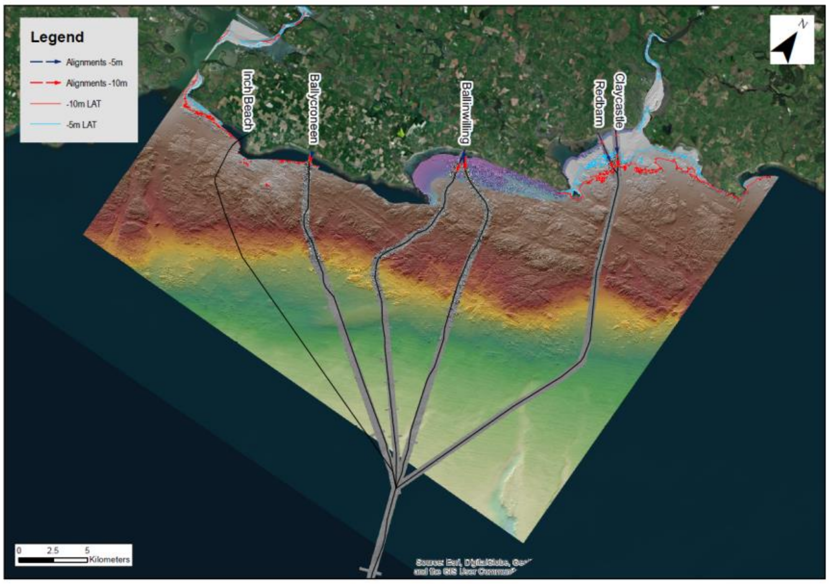


- **Early to mid-2014:** Onshore studies were conducted in both Irish and French territories to identify a range of specific landfall sites in all areas considered.

- **Mid 2014**: A Route Investigation Study[1] (reference) was undertaken in 2014 which identified an additional two route options. The objective of the desk-based study was to propose an optimised marine route for further seabed survey. The route options were assessed in detail and then ranked based on a range of different constraints such as environmental, technical, third-party and commercial constraints.
- **Mid / late 2014 to mid-2015**: Route-specific studies (marine and foreshore archaeology, UXO studies) were commissioned focusing on the best performing marine route. In addition, route modifications were made during the marine survey campaigns.
- **Late 2015 to mid-2016**: Further engineering studies (detailed fishing and shipping, burial studies and geoarchaeological assessment of vibrocore logs) were carried out to further examine the preferred route.
- **Early 2016**: The BAS identified the need for analysis of two additional options for the Irish landfalls, and a route adjustment at the French landfall approach. The survey scope for 2017-2018 was determined accordingly. The five main Irish landfall options considered are presented in Figure 6.2.

Commented [A11]: Reference to be added.

Figure 6.2 Irish Landfall Options



The landfalls were spaced along a 27km section of the east Cork coast. From West to East these are:

[1] www.eirgridgroup.com/site-files/library/EirGrid/Celtic-Interconnector-Marine-Route-Investigation.pdf

- Inch Beach (IN);
- Ballycroneen (BA);
- Ballinwilling (BW2 to the west, BW1 to the east);
- Redbarn (RE); and
- Claycastle Beach (CL – the best performing option).
- **Late 2017:** A geophysical survey campaign was undertaken covering alternative Irish landfall options and deviation near the French coast.
- **Late 2017 to early 2018**: A Cable Protection Complementary Study (CPCS) was performed to optimise all routes to minimise identified installation challenges.
- **May and June 2018**: A geotechnical survey campaign was undertaken covering alternative Irish landfall options and deviation near the French coast (including updated UXO surveys).
- **Mid to Late 2018**: A Metocean and Hydrosedimentary study was completed along the cable route and nearshore branches.
- **Late 2018 to mid-2019**: A landfall feasibility study was undertaken for the Irish and French landfalls. An Offshore Constraints Report [reference] was produced for the Irish landfall options.
- **Early to mid-2019**: The BAS was re-assessed using a Cable Burial Risk Assessment (CBRA) method to revise the burial depths.
- **Mid 2019:** An External Protection Feasibility Study was prepared to develop an understanding of the external protection requirements and designs that may be required for the route.
- **Late 2019**: The Step 4A Consultants Options Development Report [reference] was issued and included discussion on the shortlisted landfall options, Claycastle Beach, Redbarn Beach and Ballinwilling Strand.
- **Late 2020**: The Step 4B Consultants Options Development Report [reference] was issued and Claycastle Beach was identified as the Best Performing Option.

6.2 References

Commented [A12]: Reference to be added.

Commented [A13]: Reference to be added.

Commented [A14]: Reference to be added.

Commented [A15]: Reference section to be added.

7 Assessment Approach

7.1 General Approach

As described in Chapter 3, the marine licence application is being supported by an Environmental Report (ER), including a non-technical summary and associated technical reports demonstrating the outcome of the assessments undertaken for the offshore elements of the Project.

The MMO confirmed in a Screening request response dated 17 December 2020 (Appendix A) that the proposed works in the UK EEZ do not constitute a type of EIA development under the legislation in force. The MMO advised that:

> *"The MMO does not consider the regulated activity under Part 4 of the Marine and Coastal Access Act (MCAA) 2009: deposits of cable protection (ancillary works to support cable installation works) to constitute a 'Project' under either Schedule A1 or Schedule A2 of the MWRs. The MMO acknowledge that the Project Categories listed under the Schedules of the MWRs should not be interpreted too restrictively, as to exclude an activity that is not obviously listed under the schedules, however, there must be a clear link between activity and the Project Categories under the schedules. In the case of Celtic Interconnector the only regulated activities are ancillary works, deposits of cable protection, to support the laying of a cable, with neither the ancillary works nor the over-arching cable laying activities listed under the Schedules.*
>
> *Screening by determination under Regulation 7 or 8 of the MWRs is not possible since a 'cable laying' project category is not listed in the Schedules of the MWRs.*
>
> *The MMO do not agree to screen the regulated activity in by agreement under Regulation 5 of the MWRs. Regulation 5 of the MWRs states both the applicant and the Regulator must agree to screen the project into EIA voluntary. The MMO are not content to screen-in the project voluntarily."*

The Project Promotors have elected to prepare the ER so that it presents the findings of an assessment that uses methods and terminology that are in line with the requirements of the 2017 Marine Works Regulations. This is to ensure that adequate information and appraisal is provided to the MMO as decision-maker for this marine licence application, and to ensure a consistent level of environmental information across all jurisdictions of the Project.

The ER will focus on:

- Impacts that are both likely and significant; and
- Impact descriptions that are accurate and credible.

Schedule 3 of the 2017 Marine Works Regulations sets out the "*information to be included in an environmental statement*". As a non-EIA development, the ER is not an environmental statement as defined by the 2017 Marine Works Regulations and it therefore is not mandatory to comply with the full content of Schedule 3. However, the content of Schedule 3 has been referred to as a guide and as such, the ER will contain:

1. A description of the project and of the regulated activity, including details of the following matters:

   a) the location, size and nature of the project and the regulated activity;

   b) the quantity and nature and source of the materials to be used in the course of the project and the regulated activity;

   c) the quantity, nature and source of any items or materials to be deposited in the sea in the course of the project and the regulated activity; and

   d) the working methods to be used in the course of the project and the regulated activity.

2. A description of the aspects of the environment likely to be significantly affected by the project and the regulated activity, including:

   a) human beings, fauna and flora;

   b) soil, water, air, climate and the landscape;

   c) material assets and the cultural heritage; and

   d) the interaction between any two or more of the things mentioned in the preceding sub-paragraphs.

3. A description of the likely significant effects of the project and the regulated activity on the environment resulting from:

   a) the nature of the activities to be carried out and the manner in which they are to be carried out;

   b) the use of natural resources;

   c) the emission of pollutants;

   d) the creation of nuisances; and

   e) the elimination of waste.

4. The description will cover the following categories of effect:

   a) direct and indirect effects;

   b) secondary effects;

   c) cumulative effects;

   d) short-term, medium-term and long-term effects;

   e) permanent and temporary effects; and

   f) positive and negative effects.

5. The forecasting methods used by the applicant to assess the main effects that the project and the regulated activity are likely to have on the environment.

6. A description of the measures envisaged to prevent, reduce, and offset any significant adverse effects of the project and the regulated activity on the environment.

7. An outline of the main alternatives studied by the applicant and an indication of the main reasons for the applicant's choice, taking into account the environmental effects of those alternatives and the project as proposed.

8. A non-technical summary of the information provided in the ER.

9. Any difficulties, such as technical deficiencies or lack of knowledge, encountered in compiling the ER.

The initial stage of the assessment was to undertake a scoping exercise. The scoping in and out of effects in this ER has been informed by the project description as it currently stands, known baseline conditions, and additional information about the following:

- The receptors that could be affected by the proposed development;
- The activities involved in constructing and operating the proposed development;
- Changes that could result from these activities (for example, changes to water quality or sedimentary regimes as a result of the proposed development);
- The expected magnitude and other characteristics of these environmental changes and the susceptibility of relevant receptors to exposure to these changes (for example, how biodiversity receptors might be affected by changes in water quality); and
- The extent to which the design of the proposed development avoids or reduces any potential effects.

The outcomes of the scoping study are presented in Chapter 8 of this report.

7.2 Technical Topic Assessments

The approach as outlined here will be used as the basis for all technical topics. However, it is noted that topic-specific adaptions may be required to bring this in line with individual topics' requirements. Therefore, any changes or adaptions to this method shall be outlined within each individual topic chapter.

7.2.1 Identification of Receptors

Receptors with the potential to be affected by the installation, operation and decommissioning of the Celtic Interconnector Project shall be identified through:

- Review of the findings of site-specific, project-commissioned surveys and studies within the marine and coastal environment in the vicinity of the Celtic Interconnector project;
- Review of third-party data, as appropriate, outlining any known environmental sensitivities; and,
- Application of professional judgement, based on experience from other, comparable projects, in similar environmental conditions.

7.2.2 Significance Evaluation Methodology

The approach to evaluate significance shall comprise the following stages:

- Effect categorisation;

- Assignment of receptor sensitivity / importance / value;
- Determination of magnitude of change; and
- Determination of significance.

Effect categorisation

For the purposes of defining the content of the ER, effects shall be categorised as follows:

- Direct effects: Those effects that result directly from the installation of the proposed development, for example loss of seabed features during installation, operation or decommissioning;
- Indirect / secondary effects: Those effects that result from consequential change, caused by the development, potentially occurring later in time, or at a greater distance than direct effects, for example effects on wider benthic communities as a result of changes to water quality;
- Cumulative[2]: The combined action of different environmental topic-specific impacts upon a single receptor or the combined action of a number of different projects, cumulatively with the Project cable protection installation works being assessed, on a single receptor. This can include multiple impacts of the same or similar type from a number of projects on the same receptor;
- Transboundary effects: Environmental changes that would result in likely significant effects on the environment in another State or jurisdiction.

Having regard for Annex III of the EIA Directive (as amended), impacts to receptors from the effects of the Project cable protection installation works will be considered against the following factors:

a) The magnitude and spatial extent of the impact (for example geographical area and size of the population likely to be affected);

b) The nature of the impact;

c) The transboundary nature of the impact;

d) The intensity and complexity of the impact;

e) The probability of the impact;

f) The expected onset, duration, frequency and reversibility of the impact;

g) The cumulation of the impact with the impact of other existing and/or approved projects; and

h) The possibility of effectively reducing the impact.

[2] The approach to cumulative impact assessment was developed in accordance with the Planning Inspectorate Advice Note 17: Cumulative Impact Assessment

[3]Carbon dioxide equivalent (CO_2e) is a term for describing different greenhouse gases in a common unit. For any quantity and type of greenhouse gas, CO_2e represents the amount of CO_2 which would have the equivalent global warming impact.

Deleted: ¶

Receptor sensitivity and importance / value

The value of a receptor is largely a product of the importance of a feature (for example habitat, or aspect of water quality), as informed by legislation and policy, and qualified, where appropriate, by professional judgement. For example, biodiversity receptors may be defined using a geographic frame of reference as being of either international, national, regional, or local importance. For each environmental receptor, it is necessary to provide a detailed rationale that explains how the categories of importance or value have been used. The sensitivity of a receptor will be dependent on its ability to respond to change and the nature and duration of the change.

Determination of magnitude of change

The magnitude of change affecting a receptor would be identified on a scale ranging from 'negligible' to 'very high'.

As with receptor sensitivity and value, the rationale for defining magnitude is topic / receptor-specific. This can be based on, for example, the percentage of a habitat or population at risk of damage or disturbance through installation of the Celtic Interconnector.

Where applicable, the magnitude of change will be based on numerical parameters. Where quantifiable determination is not possible, professional judgement will be used to determine the magnitude of change, using descriptive terms.

Determination of significance

The significance of an effect is determined with reference to the nature of the development, receptor sensitivity, and the magnitude of change likely to occur. This shall be guided by a significance matrix that relates the sensitivity of the baseline receiving environment with the magnitude of the impact to identify a magnitude of effect and a corresponding level of significance**Error! Reference source not found.**.

Determination of significance within the ER shall be a three-step process:

- Preliminary evaluation of effects including consideration of embedded mitigation measures included within project design;
- Where significant effects cannot be ruled out, the influence of additional mitigation measures will be added to the assessment noting how these can further minimise or avoid significant effects arising; and
- Final assessment and categorisation of residual effects.

Where any deviation from the assessment approach described is necessary within topic-specific assessments, these shall be described within the relevant topic-specific chapters of the ER.

8 Technical Scope of the Environmental Report

Commented [A16]: A cross-checking exercise will be taken with the scoping advice from the MMO, once received. It will consider whether they agree with what has been scoped out of the ER.

An informal non-EIA scoping exercise was undertaken in 2020 to assess the likely significance of potential impacts and to scope these in or out of the assessment as appropriate. This included provision of a Technical Note to the MMO in January 2021. Table 8.1 lists:

- Technical topics considered
- Potential effects identified as potentially significant and therefore requiring further consideration in the Environmental Report (ER); and
- Potential Effects not likely to be significant, scoped out of the ER.

Table 8.1 Summary informal scoping exercise

Scoping Report Section	Environmental topic	Effects identified as relevant in the UK EEZ	Effects scoped out of the ER
8.1	Noise and vibration	Impacts on marine fauna from noise during installation from vessel, subsea survey and monitoring equipment, and cable installation activities (note, consideration of underwater noise and vibration from an ecological perspective is addressed under 'Biodiversity', with this section focused on noise generating activities, rather than their effects)	Noise resulting from UXO clearance
8.2	Air quality and climate	Impact of the Project on climate change through greenhouse gas emissions	Impact to local air quality from combustion emissions during installation and operational maintenance Impacts to sensitive habitats and species from the deposition of NO_X and SO_2 from installation of plant and vessels

Scoping Report Section	Environmental topic	Effects identified as relevant in the UK EEZ	Effects scoped out of the ER
			Vulnerability of the Project to climate change
8.3	Marine sediment quality	Disturbance of seabed during cable protection installation Changes in sediment transport regime	None
8.4	Marine physical processes	Disturbance to, and loss of, seabed features during cable protection installation Changes to local sediment dynamics through the presence of external cable protection during operation	Disturbance to, or loss of, seabed features due to UXO detonation
8.5	Marine water quality	Release of hazardous substances through loss of chemicals / fuels from installation vessels Changes in water quality through release of contaminants held in sediments	Discharge of wastewater and solid waste from installation vessels
8.6	Biodiversity	Impacts on marine fauna from noise during installation from vessel, subsea survey and monitoring equipment, and cable protection installation activities. Impact to birds from increased noise and human presence during installation at sea and landfall point Release of hazardous substances through loss of chemicals / fuels from installation vessels	Noise resulting from the installation of cable protection

Scoping Report Section	Environmental topic	Effects identified as relevant in the UK EEZ	Effects scoped out of the ER
		Spread of invasive non-native species Changes in water quality through increased suspended sediment, release of contaminants held in sediments and deposition of sediments during cable protection installation Disturbance to and loss of benthic habitats during cable installation	
8.7	Seascape and landscape	None	Changes to seascape character within the UK EEZ during cable protection installation and operational phases
8.8	Archaeology and cultural heritage	Direct damage / disturbance of heritage assets	None
8.9	Material assets	Risk of damage to existing in-service cables at cable crossings intersected by the Project Interactions with PEXA	Interactions with marine aggregate extraction activities, renewable power projects, and oil and gas assets
8.10	Population and human health	Disruption to fishing communities as a result of cable protection installation activities Disruption to fishing communities as a result of interference or snagging of fishing gear with cable protection	Impacts on livelihoods from disruption to vessel routing Economic benefits of cable protection maintenance and repair contracts
8.11	Shipping and navigation	Disruption to shipping routes due to exclusion	Reduced seabed depth due to placement of external cable protection (and associated

Scoping Report Section	Environmental topic	Effects identified as relevant in the UK EEZ	Effects scoped out of the ER
		zones during installation of cable protection Disruption to vessel routing during installation Risk of anchor dragging, emergency anchoring or foundering	risk of vessel grounding due to reduced keel depth) Increased collision risk during installation
8.12	Commercial fisheries	Damage / disturbance to fishing grounds during installation of cable protection Loss of access to fishing grounds due to increased presence of vessels during installation of cable protection	Risk of fishing equipment snagging on cable protection Change in distribution of target species during operation
8.13	Major accidents and disasters	Collision risk during installation Risk of accidental spills	None

The MMO has stipulated that the ER must contain certain elements as a minimum, as presented in item 4 of the letter presented in Appendix A. These are listed in Table 8,2 alongside signposting to the Chapter in this ER in which the relevant approach to each element is discussed.

Table 8.2 Signposting to required ER content

Topic Stipulated by MMO	Chapter in ER
Planning policy and legislative framework	See Chapter 2: Relevant Policy and Legislation
Development, cable route selection and alternatives	See Chapter 6: Consideration of Alternatives
Project description	See Chapter 5: Project Description

Topic Stipulated by MMO	Chapter in ER
Physical conditions and marine processes	See Chapter 12: Marine Physical Processes
Benthic ecology	See Chapter 14: Biodiversity
Fish and shellfish	See Chapter 14: Biodiversity
Marine birds	See Chapter 14: Biodiversity
Marine mammals and reptiles	See Chapter 14: Biodiversity
Protected sites	See Chapter 14: Biodiversity
Commercial fisheries	See Chapter 20: Commercial Fisheries
Shipping and navigation	See Chapter 19: Shipping and Navigation
Offshore infrastructure and other sea users	See Chapter 17: Material Assets
Recreation	See Chapter 9: Population and Health
Marine archaeology	See Chapter 16: Archaeology and Cultural Heritage
Cumulative effects	See Section 8 under each technical sub-topic
Proposed monitoring and mitigation measures	See Chapter 22 Summary of Mitigation and Monitoring Measures

In addition to the minimum requirements specified by the MMO, information is also provided in this ER in relation to population and human health (Chapter 9), air quality and climate (Chapter 10), seascape and landscape (Chapter 15), noise and vibration (Chapter 18), and major accidents and disasters (Chapter 21). This is to ensure consistency with the topic coverage of the EIA reporting in the Irish and French jurisdictions and a robust and project-wide consideration of all potential impacts of the Project.

Each technical chapter below will present the following:

- A description of the baseline receiving environment;

- The data available for informing the assessment including survey work undertaken to date, any additional data gathered in support of the assessment, and any limitations of the available data or known data gaps;
- A description of the likely significant effects resulting from the Project, including from the interaction of effects, and the identification of the proposed mitigation measures;
- A description of the proposed impact assessment methodology specific to the technical topic; and
- The rationale for scoping out any elements of the Project for full assessment where the associated impacts are unlikely to be significant.

The mitigation measures proposed in this ER are subject to advice from the MMO during the marine licence application process and the consideration of views and information obtained through ongoing stakeholder consultation. EirGrid has produced a series of guideline documents including on a standardised approach to ecological assessment and cultural heritage assessment that have also been used to inform the assessment. These commit to the implementation of appropriate and successful mitigation measures in relation to known environmental effects from its projects.

In line with Article 35 of the EIA Directive (as amended), the guidelines include a focus on the importance of monitoring the effectiveness of proposed mitigations (where appropriate). EirGrid and RTE are considering the application of monitoring in relation to the proposed mitigation measures and this is reported upon within the relevant chapters of this ER.

9 Population and Human Health

9.1 Introduction

This chapter of the Environmental Report (ER) assesses the likely significant effects of the Celtic Interconnector ("the Project") on population and human health and possible mitigation measures to avoid, reduce, or offset potential adverse impacts.

The assessment of effects in this chapter focuses on the effects related to potential interaction with the current offshore uses within the UK Exclusive Economic Zone (EEZ), guided by the Scoping Report for identification of effects, and informed by the planning documents related to the Irish and French sections of the cable route.

These effects are considered with reference to Volume 4 Environmental Report for UK Offshore – Chapter 5: Project Description; Chapter 19: Shipping and Navigation and Chapter 20: Commercial Fisheries.

The wider effects of the enhanced electricity and communications network include benefits to communities providing equipment and services during construction, such as cable and hire of cable-laying vessels, as well as lower energy costs, lower carbon impacts, increased tax revenues, and other economic benefits from construction and operation.

The following effects are scoped out:

- The possible effects of electromagnetic interference on health because the many undersea cables in operation, and the established body of related evidence, indicates that they are not seen as giving rise to significant impacts on populations, assuming their installation follows good practice; and
- Transboundary effects which are not also wider effects (and would be considered together with them).

9.2 Methodology and Limitations

9.2.1 Legislation and Guidance

The sources listed in Table 9.1 have been consulted for relevant advice and guidance.

Table 9.1 Source of guidance

Guidance	Relevance
UK Government - Green Book (2018)	Published by HM Treasury, this provides a broad framework for how policies, programmes and projects in the UK should be appraised and evaluated to inform decision making. It sets out guidelines for how the economic and social effects of policy should be conducted. It contains advice on the scoping of costs and benefits to be included in assessment, the time period for assessment and the use of discount rates. It also contains various supplementary guidance on assessment of environmental effects, of for example, health, crime and air quality.
UK Government - Additionality Guide (English Partnerships, 2014)	This provides more specific guidance on how to assess impact of a policy intervention (or a private sector investment) on the local, regional and national economy. Additionality is the *'extent to which something happens as a result of an intervention that would have not occurred in the absence of intervention'*.
OSPAR Commission: Assessment of the environmental impacts of cables (2009)	Generic information with previous examples on the effects of cables.
United Nations Environment Programme: EIA Training Resource Manual	A well-established and extensive resource with a range of guidance on many elements of EIA implementation.
The International Finance Corporation Introduction to Health Impact Assessment (2009)	The introduction to Health Impact Assessment from a branch of the World Bank takes the approach of assessing impacts within specific Environmental Health Areas which collectively cover similar topic areas to the WHO in their guidance and tools (above).
International Union for the Conservation of Nature: Social Impact Assessment in Environmental & Social Management System	The guidance provides a succinct summary of the key elements in assessment as and supplementary guidance focusing on the natural context.
Glasson, J, Socio-economic impacts 1: economic impacts (2009)	This source of socio-economic guidance is from the practitioners' established general reference for EIA.
International Association for Impact Assessment: Social	The guidance provides a thorough source of detailed methodologies for conducting activities supporting social

Guidance	Relevance
Impact Assessment: Guidance for Assessing and Managing the Social Impacts of Projects	assessment particularly those for identifying and representing community issues and assessing methods of resolution.
The World Health Organization Health Impact Assessment guidance, tools and methods	The guidance, tools and methods are recognised as the leading international authority on the completion of health impact assessments.

9.3 Desktop Studies

9.3.1 Data and Surveys

Previous reports from EirGrid provide background relevant to the assessment. These are listed in the references section and include:

- EirGrid, Celtic Interconnector, Strategic Social Impact Assessment Scoping Report, April 2019; and
- EirGrid, Social Impact Assessment Baseline Report Celtic Interconnector Project, April 2017.

9.4 Field Studies

No field studies were considered necessary to inform this assessment; therefore no field work has been undertaken.

9.5 Methodology for Assessment of Effects

9.5.1 Distance and scope

The geographical scope of the Project assessed in this chapter is limited to the section of the works within the UK EEZ.

The installation of the cables requires construction works, with the associated potential for effects to arise for marine users, such as people involved in fishing, shipping and navigation. The zone of influence is therefore taken as that used to assess fishing, shipping and navigational effects (See Volume 4 Environmental Report for UK Offshore - Chapter 19: Shipping and Navigation and Chapter 20: Commercial Fisheries).

During operation, the cables provide benefits in Ireland and France resulting from more efficient use of electricity and communication systems. The UK is not directly connected to the cable, therefore operational effects are limited to those related to possible disruption to fishing and to cable maintenance.

Decommissioning activities are similar in nature to construction and require a similar scope of effects to be considered.

9.5.2 Assessment of Significance

The significance of the impacts on population and human health is the primary concern of the assessment and is undertaken with and without taking account of measures providing mitigation. The assessment first considers impacts according to the estimated magnitude of change from the baseline and the sensitivity of receptors including only the mitigating measures ‘embedded’ in the design, such as the adoption of good practice techniques. Further set of measures that enhance or mitigate socio-economic and health impacts are considered separately in order to derive the residual impacts used for the final assessment of significance.

9.5.3 Magnitude of change

The ‘magnitude of change’ is used to describe an effect which can be represented as varying over a range. Simple effects may be represented with quantitative indicators, but semi-quantitative or qualitative indicators may be used to cover aspects such as:

- The duration and frequency of effects and whether they are permanent or time-limited (short, medium, long);
- The direction of change and its reversibility; and
- The probability of occurrence.

The assessment of the magnitude of change is based on a comparison with baseline conditions and / or with comparators from similar developments or modelled scenarios.

9.5.4 Sensitivity of receptors

Impacts are defined in terms of their consequences for one or more receptors. Receptors covering human populations are broadly defined and may be characterised as individuals, groups, communities, business sectors, recreational groups or in an extensive variety of other ways which also depend on the type of impact.

The sensitivity of a receptor is a summary term that describes the ability of the receptor to withstand or absorb change within the period of time the impact is expected to occur and without a fundamental change to its character or attributes. Sensitivity has no single interpretation and can be seen as capturing the concept of a value that is potentially threatened or enhanced.

Sensitivity of receptors may depend on their current and future characteristics as well as the nature of the impact, reflecting aspects such as:

- Vulnerability due to pre-existing social circumstances or health conditions;
- Cultural values, including public interest, perceptions towards a risk or potential change, and acceptability;
- Environmental vulnerability of habitats important in the socio-economic and health context;
- The direction, duration and reversibility of the specific impacts; and
- The capacity and availability of resources or contextual factors.

9.6 Assessment of significance

The significance of impacts is assessed based on the combination of the magnitude of an effect and the sensitivity of the affected receptor. The assessment of significance should be clear and consider aspects such as:

- Reflecting procedure and guidance applicable in the jurisdiction for Ireland;
- Consistency, showing reference to underlying reasoning and rationales where applicable;
- Using widely agreed reference points, such as health, safety and environmental standards;
- Meeting public concerns, particularly over health and safety; and
- Being easy-to-use and explain.

Where other information is not available, professional judgement has been used to assess impacts in a manner that aims to reflect whether the general population would judge the impact to be of concern or not.

9.6.1 Summary of significance

The summary of significance is presented in a table showing each effect identifying whether it is beneficial or adverse together with additional summary information.

9.7 Difficulties Encountered

The assessment reflects the data and information in Volume 4 Environmental Report for UK Offshore - Chapter 19: Shipping and Navigation and Chapter 20: Commercial Fisheries. The caveats from those chapters apply, including comments on the availability of data.

9.8 Receiving Environment

9.8.1 Location

The section of the cable route assessed here is that within the UK EEZ. The locations of populations potentially affected include the ports, shipping lanes and sea areas of marine users.

The scoping report identified the marine users from fishing communities as those who are potentially affected with the commercial fisheries assessment noting that marine users who are commercial fishers are based across a number of countries including the UK, Ireland, Belgium, France and Spain.

Across the types of species caught, the UK share of the catch for the sea areas through which the interconnector route passes (the ICES Sub Divisions) is a maximum of 6.36% of the value of the total landings in the UK EEZ (for John Dory) which amounts to a value of £102,000 for this species. The sea area with the greatest value catch of a single species is ICES Sub Division 27E3 where the Monkfish catch of 350 tonnes is worth approximately £1m and makes up 1.69% of landings in the UK EEZ.

The assessment below is based on the effects on all marine users, recognising that UK marine users will only be a proportion of these.

Commented [A17]: Placeholder – cross reference to the relevant figure in the Commercial Fisheries chapter will be made here.

9.9 Characteristics of the Development

The Project involves installation and operation of two electrical cables and one fibre-optic cable along a linear corridor from Ireland to France. The marine cable route within the UK EEZ is approximately 211km long, passing approximately 30km to the west of the Isles of Scilly and approximately 75km to the west of Land's End on the UK mainland. The marine cable route does not enter UK Territorial Waters.

The Celtic Interconnector route crosses fishing areas and 10 active subsea cables. The cable laying vessels associated with the project may occupy and prevent access to individual fishing grounds for the time it takes to install the cable, may introduction obstructions on vessel routes, and may damage or interrupt operations of existing cables. The new cable will be buried (and protected, where necessary) in a manner designed to avoid impacts on commercial fishing.

The burial and trenching operations proceed for an estimated 139 days, with a cable footprint anticipated to be c. 5-30m wide. The cable laying vessels will be categorized as vessels of restricted maneuverability and operating and navigational rules require other vessels to take appropriate avoidance measures.

During construction there will be a temporary period of less than one month of intermittent activities requiring a mobile exclusion zone around the cable laying operation of 500m radius.

9.10 Likely Significant Impacts of the Development

9.10.1 Do Nothing

Due to the type of development, it is unlikely that the Celtic Interconnector has led to any expectations which have already resulted in socio-economic or health impacts within the UK. As a result, people are unlikely to have taken action or incurred costs specifically in relation to it.

The Do Nothing scenario is therefore assessed as having no significant impacts.

9.10.2 Construction Phase

Impacts on marine users

The main impacts on marine users in the area arise from the additional vessel movements and disturbance to the existing marine environment resulting from the operations to prepare the sea floor and install the cable as well as any prior investigatory operations. The main impact on marine users is related to the lack of flexibility in the positioning of the vessels, the disturbance to the sea floor, and in the timing of operations.

The effects on commercial fishing marine users would result from effects on fishing activities, which could lead to a fall in the value of catches. The assessment of commercial fishing (see Volume 4 Environmental Report for UK Offshore - Chapter 20: Commercial Fisheries) considers effects on fishing grounds through disruption to the seabed and displacement of fishing activity and concludes that effects are negligible or minor and not significant. The related economic effects would be further muted as both fishers and fishing business (boat) owners would be able to mitigate effects through redeployment and would not require any adaptation in behaviour beyond that required more generally.

Effects on marine users who are involved in shipping and navigation would include the presence of one or more vessels classed as restricted in their ability to manoeuvre whilst undertaking project works. This has the potential to increase risk of collision; however, through implementation of best practise, and adherence to standard regulations, the effects have been assessed as minor and not significant. As a result, it is considered that there will be no significant effects on the shipping community from an economics perspective. Consideration of impacts on health due to incidents at sea has been further considered in Volume 4 Environmental Report for UK Offshore - Chapter 21 – Major Accidents and Disasters, which also concluded there would be no significant effects.

Effects on marine users who operate existing cables are unlikely because of the known positions of cables and proposed engineering designs. Additional detail on existing cables, and the need for Cable Crossing Agreements is presented in Volume 4 Environmental Report for UK Offshore - Chapter 17: Material Assets.

Overall, the sensitivity of marine users is assessed as low. The magnitude of impact is assessed as low and the effects are assessed as negligible and not significant.

Impacts on UK economy and employment

The installation of the cable will require the deployment of a workforce and purchase of services in a chain of supply. The execution of the complete project requires a range of services some of which are common to all parts, such as cable manufacture, while others are focused on marine or terrestrial elements, such as vessel hire.

As the project is linking the Irish and French electricity networks, and being delivered by Irish and French utility providers, it is unlikely that these services will be obtained from the UK economy. However, although no economic benefit is anticipated, neither are any adverse effects predicted.

Impacts on UK government revenues

The United Nations Convention on the Law of the Sea permits the installation of interconnectors. Impacts on UK government revenues would arise only from purchasing resulting from the Project affecting the UK economy. As outlined above, such purchases are not expected.

9.10.3 Operational Phase

Impacts on marine users

Effects on marine users arise from impacts on populations involved in or affected by impacts on commercial fishing or related to shipping and navigation.

The effects on commercial fishing marine users would result from effects on fishing activities, which could lead to a fall in the value of catches as well as loss or damage to fishing gear. Commercial fishing is considered in the operational phase as potentially affected by: seabed obstructions interfering with demersal fishing (trawling); exposed cable causing a safety risk; and disruption to fishing activity from cable maintenance (see Volume 4 Environmental

Report for UK Offshore - Chapter 20: Commercial Fisheries) and the effects on commercial fishing are assessed as negligible or minor and not significant.

As outlined above, effects on marine users who are involved in shipping and navigation are centred primarily around the risk of collision. However, the presence and number of project-related vessels will be minimal during the operational phase, limited to periodic surveys of the cable route, and completion of maintenance, as required. Through adherence to guidance and regulations, as outlined in Volume 4 Environmental Report for UK Offshore - Chapter 19: Shipping and Navigation, the risk has been considered to be negligible and not significant.

Effects on marine users who operate existing cables are unlikely because of the known positions of cables and knowledge of the installation used for the Proposed Development.

Overall, the sensitivity of marine users is assessed as low. The magnitude of impact is assessed as low and the effects are assessed as negligible and not significant.

Impacts on UK government revenues

The United Nations Convention on the Law of the Sea permits the installation of interconnectors within another the EEZ of another country and so revenue and trade flows would not be subject to UK taxes or duties. This potential effect would not occur and is effectively scoped out.

9.10.4 Decommissioning Phase

A decommissioning plan will be prepared prior to the decommissioning phase of the proposed development, which is expected to be at least 40 years from the start of operation. It is currently anticipated that the cable and associated external cable protection will be left in-situ where this is deemed environmentally acceptable; this may require a level of long-term monitoring and maintenance. There are not expected to be any effects on population and health as a result of this proposed course of action. However, any works required for decommissioning will be subject to future consent applications, and environmental assessments, as relevant.

9.10.5 Transboundary impacts

There are no transboundary impacts on population and human health anticipated with regards to the Celtic Interconnector in the UK EEZ.

9.10.6 Cumulative Effects

There are no known developments which could lead to cumulative effects, in particular no other projects have been identified involving construction activity or new seabed installations on the open coast in the vicinity in the cable route (See Volume 4 Environmental Report for UK Offshore - Chapter 19: Shipping and Navigation).

9.11 Mitigation and Monitoring Measures

Commented [A18]: Placeholder: All mitigation and monitoring measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

The potential effects on population and human health arise from effects considered in Volume 4 Environmental Report for UK Offshore - Chapter 19: Shipping and Navigation and Chapter 20: Commercial Fisheries, and no additional mitigation or monitoring specific to population and human health is considered to be required.

9.11.1 Residual Impacts

Potential Impact Receptor	Sensitivity of receptor	Magnitude of impact	Significance of effects before mitigation	Mitigation	Significance of effects after mitigation
Construction Phase					
Marine users – commercial fishers	Low	Low	Negligible – Not significant	Not required	Negligible – Not significant
UK Economy and Employment	N/A	N/A	N/A	N/A	No change
UK Government revenues	N/A	N/A	N/A	N/A	No change
Operational Phase					
Marine users – commercial fishers	Low	Low	Negligible – Not significant	Not required	Negligible – Not significant
UK Government revenues	Scoped out – not applicable				

9.12 References

EirGrid, Celtic Interconnector, *Strategic Social Impact Assessment Scoping Report*, April 2019;

EirGrid, *Social Impact Assessment Baseline Report Celtic Interconnector Project*, April 2017; and

English Partnerships (2014). Additionally Guide, English Partnerships, a Standard Approach to Assessing the Additional Impact of Projects, Fourth Edition.

HM Treasury (2018). Central Government Guidance on Appraisal and Evaluation, [online]. Available at: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent.

10 Air Quality and Climate

10.1 Introduction

This chapter considers the likely impacts of the Greenhouse Gases (GHG) emissions associated with the Project on the global climate. The only receptor for Greenhouse Gases assessment is the global climate. Any increase or decrease to GHG emissions against the future baseline can be considered to be significant based on their effect on the global climate, which is the largest interrelated cumulative environmental effect. The vulnerability of the Project to climate change was scoped out of the assessment on the basis that the projections for climate change and the hazards associated with changes to the climate are unlikely to affect offshore Project assets or the environmental mitigations put in place and there is no potential for a significant effect.

The impact of the Project on sensitive ecosystems as a result of changes to regional air quality during operation has been scoped out of the assessment as no significant change to ambient air quality in the short or long term is expected as a result of the Project. All impacts related to emissions of pollutants to air were removed from the scope of the assessment at the scoping stage.

The remainder of this chapter will therefore focus on the GHG assessment only.

10.2 Methodology and Limitations

10.2.1 Legislation and Guidance

The United Nations Framework Convention on Climate Change (UNFCCC) is the major international body responsible for managing climate change and carbon emissions. In 2015, it adopted the Paris Agreement, which aims to limit *"the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels"* (UNFCCC, 2015).

In light of the Paris Agreement and a recent Intergovernmental Panel on Climate Change (IPCC) report (IPCC, 2018), the UK government requested updated advice from the Committee on Climate Change (CCC) on the UK's long-term emission target. This advice was given in the report, '*Net Zero. The UK's contribution to stopping global warming*' (CCC, 2019). The UK government has heeded the CCC advice and amended the target in the Climate Change Act 2008 (UK Government, 2008) such that the net UK carbon account for the year 2050 is at least 100% lower than the 1990 baseline.

The Climate Change Act 2008 (as amended) (UK Government, 2008) requires the Secretary of State to set successive five-year carbon budgets ('the UK carbon budgets') to meet the UK carbon target for 2050 (UK Government, 2016). International aviation and shipping (IAS) emissions are not currently included in the UK carbon target or legislated UK carbon budgets, but the UK carbon budgets are to be set 'having regard to' IAS emissions.

The Fifth carbon budget covers the period 2028-2030 (UK Government, 2016), and is set at 1,765 million tonnes carbon dioxide equivalent ($MtCO_2e$)[3]. The CCC has recommended a Sixth carbon budget of 965$MtCO_{2e}$ including IAS emissions, implying a 78% reduction in UK emissions from 1990 to 2035 (CCC, 2020). It should be noted that the Sixth carbon budget has not yet been set in law although this is anticipated in 2021. The UK government's Nationally Determined Contribution (NDC) under the Paris Agreement is to reduce the UK's emissions by at least 68% by 2030, compared to 1990 levels (UK Government, 2020).

The Clean Maritime Plan (supported by the policy paper known as 'Maritime 2050 – Navigating the Future') published in July 2019 is the UK government's strategic vision for the future of the maritime sector. It includes a strategy for the UK's transition to zero emission shipping. To meet the ambition of achieving zero emission shipping by 2050, the Clean Maritime Plan specifies that by 2025, it is expected that:

i. All vessels operating in UK waters are maximising the use of energy efficiency options. All new vessels being ordered for use in UK waters are being designed with zero emission propulsion capability. Zero emission commercial vessels are in operation in UK waters.

ii. The UK is building clean maritime clusters focused on innovation and infrastructure associated with zero emission propulsion technologies, including bunkering of low or zero emission fuel.

By 2035, it is expected that:

iii. The UK has built a number of clean maritime clusters. These combine infrastructure and innovation for the use of zero emission propulsion technologies. Low or zero emission marine fuel bunkering options are readily available across the UK.

iv. The UK Ship Register is known as a global leader in clean shipping and the UK is home to a world-leading zero emissions maritime sector, with:

a. a strong UK export industry;

b. cutting-edge research and development activities;

c. the global centre for investment, insurance and legal services related to clean maritime growth.

10.2.2 Desktop Studies

The only receptor for GHG emissions is the global climate. In 2019 the UK's GHG emissions were 454.8 $MtCO_2e$ (BEIS, 2020a). GHG emissions from energy supply accounted for 95.8 $MtCO_2e$, approximately 21% of total GHG emissions.

10.2.3 Field Studies

No survey work has been necessary specifically for the GHG assessment.

10.2.4 Methodology for Assessment of Effects

[3] Carbon dioxide equivalent (CO_2e) is a term for describing different greenhouse gases in a common unit. For any quantity and type of greenhouse gas, CO_2e represents the amount of CO_2 which would have the equivalent global warming impact.

The approach to the GHG assessment is to quantify GHG emissions and then contextualise them against the international agreements and associated national commitments for reducing GHG emissions.

GHG emissions are quantified as carbon dioxide equivalent (CO_2e).

A range of GHG emissions sources have been considered in the quantification assessment. The approach presented in this Volume of the ER does not represent a full life-cycle assessment as Volume 4 UK Offshore ER only considers the Project elements within the limits of the UK Exclusive Economic Zone (EEZ). The emission sources considered in this assessment are:

- Embodied emissions – to estimate GHG emissions associated with the materials used to construct the Project including submarine cables, concrete mattresses / rock placement at cable crossings and rock placement for external cable protection.
- Transport of materials to site – to estimate GHG emissions from transport of materials, vessels, equipment and workers to offshore sites.
- On-site energy usage – to estimate GHG emissions associated with the installation works including GHG emissions associated with ships conducting the offshore cable laying works.
- Avoided emissions – the emissions avoided from fossil fuel-based energy generation as a result of the Project.

A proportionate approach is taken to ensure that undue attention is not placed on emission sources that have very limited impact on the overall scale of emissions. Emission sources that contribute <1% of emission inventories have been excluded from the assessment.

Activity data (material type, quantities required, progress rates etc.) for each emission source has been primarily based on the details within the current design of the Project described in Volume 4 Environmental Report for UK Offshore – Chapter 5: Project Description. Where this information does not yet exist due to the design stage, information has been sourced from relevant specialists within the design team, literature studies or previous studies conducted as part of earlier preliminary work for this Project. This data has been multiplied by relevant emission factors sourced from the Inventory of Carbon and Energy (ICE) Database (Circular Economy, 2019) and literature studies to calculate the associated emissions measured in kilo-tonnes of CO_2e ($ktCO_2e$).

Embodied carbon of the cable has been estimated at $191.2tCO_2e/km$ based on recent studies of similar design to the Project (Birkeland, 2011; Arvesen et al, 2014; North Connect, 2018; AQUIND Limited, 2019).

There are 10 in-service telecommunication cable crossings identified along the cable route considered in this assessment (see Volume 4 Environmental Report for UK Offshore – Chapter 5: Project Description for details), all in UK EEZ waters. Each cable crossing will require a specific crossing design using secondary protection to be agreed with each asset owner at a later date. Secondary protection at cable crossings will be based on either the use of concrete mattresses or rock placement and will be decided as the Project design develops.

An assumption of five crossings by concrete mattresses and five crossings by rock placement has been used to represent an even split between the available options. Typical quantities of rocks (1,237m^3) and concrete (75.6m^3) required per crossing have been estimated and multiplied by emission factors sourced from the Inventory of Carbon and Energy (ICE) Database (Circular Economy, 2019) as described in Table 10.1.

Estimated rock quantities for secondary rock protection are provided in Volume 4 Environmental Report for UK Offshore – Chapter 5: Project Description, the worse-case values have been used in the GHG assessment. These have been multiplied by emission factors sourced from the Inventory of Carbon and Energy (ICE) Database (Circular Economy, 2019).

Table 10.1 GHG Emission Factors for Materials from the ICE Database

Material	Emission factor (kgCO_2e/kg)
Concrete (general)	0.103
Stone	0.079

Transportation of materials, ships and crew, and equipment to offshore sites is assumed to be by marine methods (i.e., boats, not helicopters). Transit times have been estimated based on anticipated origin ports (Table 10.2).

Table 10.2 Port Origins, Estimated Transit Times and Assumed Number of Journeys for the Different Vessel Types Required in the Installation Phase

Vessel type	Port origin	Transit time assumed (hrs)*	Assumed number of journeys
Geophysical survey vessel	UK location based on 2015 Geophysical survey conducted on the Project	12	One return journey for pre-work survey, one return journey for post-work survey
Route clearance vessel	Continental Europe based on anticipated suppliers	37	One return journey
Cable lay vessel			Two return journeys, inclusive of one winter de-mobilisation period during the construction phase
Sandwave sweeping vessel			One return journey
Supply barge (cable laying supplies)			Based on one return journey per month (including partial months) of

Vessel type	Port origin	Transit time assumed (hrs)*	Assumed number of journeys
			the construction period, assumed to require 5 return trips.
Supply barge (rock placement)	Norway	68	Based on one return journey.

*Transit distances to Cork have been calculated from representative origin ports, with the distance between Cork and the mid-point of the UK EEZ section deducted (256km). The transit time is calculated based on an average travel speed of 13 knots. The distance from UK ports is based on the average of distances from the following ports: Liverpool and Portland Harbour. The distance from continental Europe ports is based on the average of distance from the following ports: Rotterdam, Antwerp, Hamburg, Bremerhaven and Le Havre. The distance from Norwegian ports is based on the average of distance from the following ports: Tromso, Bergen, Haugesund, Stavanger, Oslo, Drammen and Kristiansand.

Fuel efficiency of the different ship types has been estimated based on previous studies and typical ships, see Table 10.3.

Table 10.3 Fuel Efficiency of Different Vessel Types Required in the Installation Phase

Vessel type	Fuel efficiency (l/hr)	Source
Geophysical survey vessel	104	Based on efficiency of S.V Bibby Tethra used in 2015 Geophysical survey for the Project
Route clearance vessel	442	Based on typical anchor-handling vessels (Bourbon, 2009; Bourbon, 2014; Clarkons Research, 2007)
Sandwave sweeping vessel	442	Based on vessel of a similar size to the route clearance vessel.
Cable lay vessel	573	Birkeland, 2011
Supply barge (cable laying supplies)	100	Birkeland, 2011
Supply barge (rock placement)	100	Birkeland, 2011

Based on the hours of transit and fuel efficiency of the vessels, the volume of fuel has been determined. It has been assumed that all vessels use heavy fuel oil (HFO). Emission factors for HFO have been determined based an average factor of 3,085kgCO_2e/tonne derived from the average of three datasets (BEIS, 2020c; IMO, 2014; EPA, 2014).

Energy use for processes on construction vessels have been estimated based on the HFO consumed during the construction processes (i.e., not including the transit times). Hours of use have been estimated based on rates described in Volume 4 Environmental Report for UK Offshore – Chapter 5: Project Description and Chapter 6: Consideration of Alternatives and previous surveys for the Project. The pre-clearance of boulders is assumed to require 30 days of shipping time based on expert judgement from the engineering design team. The sandwave sweeping is assumed to require 4 days of shipping time based on previous studies (Smart Wind, 2015; Dong energy, 2017; ON&T, 2020; Rotech Subsea, 2020). Vessel efficiencies and HFO emission factors are calculated as for marine transport emissions.

Energy usage from vessels for monitoring and maintenance during the operational stage of the Project are expected to be infrequent and of relatively short duration. Monitoring of the in-situ cable in the decommissioning stage of the Project will also be minimum. These emission sources are deemed negligible for the purposes of this assessment.

The quantified emissions are considered in relation to their impact on the global climate system, which is achieved by contextualising them against their impact on national government's ability to meet international climate agreements (i.e., the Paris Agreement (UNFCCC, 2015)) and individual nations associated climate targets.

10.2.5 Difficulties Encountered

No difficulties were encountered in the development of this Chapter.

10.2.6 Receiving Environment

The receptor for all GHG emissions is the global climate. Given the global impacts of climate change and the globally recognised requirement to limit GHG emissions to maintain global average temperature increase below 2°C, as laid out in the Paris Agreement (UNFCCC, 2015), the receptor is considered highly sensitive to emissions. GHG emissions to the receptor are considered direct and negative, and the effects on the receptor are permanent.

10.2.7 Characteristics of the Development

The materials used during installation of the Project, particularly the cable itself, will have an associated carbon footprint (its embodied carbon).

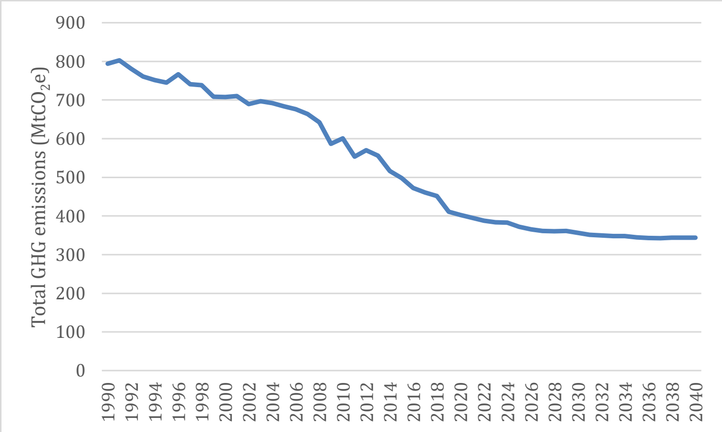
During operation, it is anticipated that the Project will lead to reduced GHG emissions. The Project will connect regions currently isolated from European energy markets, strengthen existing cross-border interconnections, and help integrate renewable energy sources (RES) (EirGrid and RTE, 2018). The increased reliance on variable RES generation means that weather will have a greater impact on the future energy system. In this context, the Project will help to maintain security of supply (SoS) while optimising the efficient use of energy resources. As a result, the amount of power generated by combustion of fossil fuels will be reduced.

10.3 Likely Significant Impacts of the Development

10.3.1 Do Nothing

Total GHG emissions at a national level in the UK are anticipated to decrease over time as a result of decarbonisation efforts and emission reduction targets and initiatives. Energy and emission projections, published prior to the UK setting its NDC, project a decrease in total GHG emissions out to 2040 (Figure 10.1). Included in the assumptions are government policies which have been implemented, adopted or planned as of August 2019. It excludes new policies and changes to existing policies since this date. If these were included, the level of emissions reported here would be lower. Interconnectors between the UK and other countries are included in the assumptions, but the Celtic Interconnector is not specifically included as the Project does not make landfall in the UK. In the Do Nothing scenario, there will be no GHG emissions (beneficial or adverse) as a result of Project.

Figure 10.1 Future Projections of GHG Emissions in the UK (BEIS, 2020b)



10.3.2 Installation Phase

This section quantifies the GHG emissions during the installation phase. Projected GHG emissions associated with the installation of the Project are estimated to be 91.05ktCO_2e. The breakdown of emissions by the different sources is described in Table 10.1.

Table 10.4 GHG Emissions Associated with the Installation of the Project

Activity		**GHG emissions (ktCO2e)**	**% contribution to total emissions**
Embodied carbon emissions	Submarine cable	80.69	88.6%
	Cable crossings	1.41	1.6%
	Rock placement for external cable protection	0.02	0.0%

Activity		GHG emissions (ktCO2e)	% contribution to total emissions
Transportation of materials to site[4]	Marine Transport	0.63	0.7%
Construction process emissions	Shipping emissions	8.28	9.1%
TOTAL		91.03	100%

10.3.3 Operational Phase

This section quantifies the GHG emissions during the operational phase. The Project in its entirety is predicted to allow for the integration of between 688 and 884 GWh a year of RES (depending on future energy scenario for Europe) in 2030. This corresponds to a reduction in CO_2 emissions of between 65 and 605kt/year due to changes in generation dispatch and unlocking RES potential (EirGrid and RTE, 2018). On average, the Project leads to a CO_2 reduction of 331ktCO_2/yr.

The operational life of the electrical cables is expected to exceed 40 years and therefore the total operational saving will be a minimum of 2,600 – 24,200ktCO_2 (average of 13,240ktCO_2). Installation GHG emissions for the UK offshore sector of the Project therefore account for 0.69% of the Projects operational carbon saving[5].

The use of vessels deploying subsea survey and monitoring equipment such as multibeam echosounder for completion of periodic operational maintenance surveys will use similar equipment and methods to those described during installation. Vessel movements are expected to be infrequent and of a relatively short duration. Emissions will therefore be negligible for the purpose of this assessment.

10.3.4 Decommissioning Phase

A decommissioning plan will be prepared prior to the decommissioning phase of the proposed development, which is expected to be at least 40 years from the start of operation. It is currently anticipated that the cable and associated external cable protection will be left in-situ where this is deemed environmentally acceptable; this may require a level of long-term monitoring and maintenance. There are not expected to be any effects on marine physical processes and sediments as a result of this proposed course of action. However, any works required for decommissioning will be subject to future consent applications, and environmental assessments, as relevant.

[4] The assessment assumes that construction processes for the UK EEZ section of the overall Project are conducted in isolation to the other sections of the Project. The assessment therefore includes emissions associated with return transportation of materials/vessels to/from their origin at the start and end of the UK EEZ construction period. In practice this transportation will be coordinated among the offshore aspects of the Project in Irish and French waters and these emissions are therefore likely over-representative.
[5] Note this is likely an over-estimation as the installation emissions are quantified as carbon dioxide equivalent whereas the lifetime carbon reduction associated with the Project is measured as carbon dioxide only.

10.3.5 Overall Impact of GHG Effects during installation, operation and decommissioning

This Project will interconnect power grids and is anticipated to facilitate development and use of renewable energy sources (EirGrid and RTE, 2018). The average projected emissions reduction is 331kt/yr CO_2 per year in 2030. The calculated GHG emissions for this section of the Project, which are almost entirely related to installation, account for 0.69% of the Project's operational carbon saving over its operational life.

The receptor for the GHG emissions is the global climate and as such, impacts will be global and cumulative in nature. The reduction in GHG emissions associated with the Project will directly reduce GHG emissions from the Irish and French energy sectors. While there will not be an associated reduction in emissions from the UK energy sector, overall GHG emission contributions to the global receptor will be reduced.

The Project is therefore assessed as having a beneficial effect on GHG emissions over its lifetime. Estimating the scale of that beneficial effect would require an assessment of the GHG emissions associated with the entire interconnector Project, rather than just the UK EEZ element of it. However, given the low operational emissions, the estimations of onshore GHG and Irish offshore GHG emissions produced concurrently, and the operational lifespan of at least 40 years, it is clear that a net GHG benefit to the global climate would be apparent.

10.3.6 Cumulative Effects

With the Celtic Interconnector installed, integration with RES will be improved, increasing the viability of RES projects and therefore enabling further reductions in emissions.

The receptor for GHG emissions is the global climate and the impacts will be global and cumulative in nature. It is the cumulative effect of all GHG emissions that contribute to climate change rather than the impacts of one specific project or indeed one country. Therefore, the GHG assessments in this chapter can be regarded as a cumulative assessment of the impacts of GHG emissions. No further assessment has therefore been undertaken.

10.4 Mitigation and Monitoring Measures

Commented [A19]: Placeholder: All mitigation and monitoring measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

10.4.1 Installation Phase

The GHG emissions associated with the installation of the Project are expected to be minimal and offset by the overall GHG emission benefit generated by the Project. Further mitigation is therefore not considered essential, although best practice operations, approaches and techniques will be followed in the detailed design stages. This will include limiting GHG emissions from the earliest stage possible to ensure the greatest reductions can occur. The following high-level approach shall be applied and developed when seeking to reduce GHG emissions (as stipulated within PAS 2080):

- Build nothing: the design will evaluate the basic need for an asset and / or programme of works and shall explore alternative approaches to achieve outcomes set by the asset owner / manager;

- Build less: the design will evaluate the potential for re-using and / or refurbishing existing assets to reduce the extent of new construction required;
- Build clever: the design will consider the use of low carbon solutions (including technologies materials and products) to minimise resource consumption during the construction, operation and user's use stages of the asset or programme of work; and
- Build efficiently: the design will use techniques (e.g. construction, operational) that reduce resource consumption during the construction and operation phases of an asset or programme of work.

10.4.2 Operational Phase

The GHG emissions associated with the operation of the Project are anticipated to reduce GHG emissions. No further mitigation is considered essential, although the best practice approach described in Section 10.1.1. will limit GHG emissions during the operational phase.

10.4.3 Residual Impacts

The Project as a whole will reduce GHG emissions, and therefore be beneficial with regards to greenhouse gas emissions.

10.5 References

AQUIND Limited. (2019). Environmental Statement – Volume 1 – Chapter 28 Carbon and Climate Change. [Online]. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN020022/EN020022-000596-6.1.28%20ES%20-%20Vol%201%20-%20Chapter%2028%20Carbon%20and%20Climate%20Change.pdf [Accessed 22 December 2020].

Arvesen, A., R. Nes, D. Huertas-Hernando, and E. Hertwich. (2014). Life cycle assessment of an offshore grid interconnecting wind farms and customers across the North Sea. [Online]. Available from: https://core.ac.uk/download/pdf/52112382.pdf [Accessed 22 December 2020].

BEIS. (2020a). Final UK greenhouse gas emissions national statistics. [Online]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/957605/final-greenhouse-gas-emissions-tables-2019.xlsx [Accessed 04 March 2021].

BEIS. (2020b). Updated energy and emissions projections: 2019. [Online]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/931323/updated-energy-and-emissions-projections-2019.pdf [Accessed 22 December 2020].

BEIS. (2020c). UK Government GHG Conversion Factors for Company Reporting. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/891106/Conversion_Factors_2020_-_Full_set__for_advanced_users_.xlsx [Accessed 22 December 2020].

Birkeland, C. (2011). Assessing the Life Cycle Environmental Impacts of offshore Wind Power Generation and Power Transmission in the North Sea. [Online]. Available from: https://ntnuopen.ntnu.no/ntnu-xmlui/bitstream/handle/11250/257062/440527_FULLTEXT01.pdf?sequence=1&isAllowed=y [Accessed 22 December 2020].

Bourbon. (2009). Ailette – Oil recovery anchor handling tug supply vessels. [Online]. Available from: https://www.bourbonoffshore.com/sites/default/files/documents-associes/pdf/ailette-64-mt-bp.pdf [Accessed 22 December 2020].

Bourbon. (2014). Bourbon Liberty 300 Series – Anchor handling Tug Supply Vessel. [Online]. Available from: https://bourbonoffshore.com/sites/default/files/documents-associes/pdf/bourbon-liberty-300-series-commercial-leaflet.pdf [Accessed 22 December 2020].

CCC. (2019). Net Zero. The UK's contribution to stopping global warming. [Online]. Available from: https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf [Accessed 22 December 2020].

CCC. (2020). The Sixth Carbon Budget – The UK's path to Net Zero. [Online]. Available from: https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf [Accessed 22 December 2020].

Circular Economy (2019). Embodied Carbon – The ICE Database. [Online]. Available from: https://circularecology.com/embodied-carbon-footprint-database.html [Accessed 22 December 2020].

Clarksons Research. (2007). Anchor Handling Tugs and Supply Vessels. [Online]. Available from: https://www.crsl.com/samples/AHTS-W-JAN-07-Sample(1).pdf [Accessed 22 December 2020].

Department for Transport (2019) Maritime 2050 Navigating the Future [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/872194/Maritime_2050_Report.pdf

Department for Transport (2019) The Clean Maritime Plan [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815664/clean-maritime-plan.pdf

Dong Energy. (2017). Hornsea Project Three Offshore Wind Farm. Preliminary Environmental Information Report: Chapter 3: Project Description. [Online]. Available at: https://orstedcdn.azureedge.net/-/media/www/docs/corp/uk/hornsea-project-three/how03_peir_volume-1-chapter-3_project-description.ashx?la=en&rev=3b51266b37c2493dbb2f3838e0d1b589&hash=6E3B540BC10A200F458ABB3FCB06951F [Accessed 22 December 2020].

EirGrid and RTE (2018). Cletic Interconnector Project -Investment Request File. [Online]. Available from: https://www.cru.ie/wp-content/uploads/2018/12/CRU18265a-Celtic-Investment-Request.pdf [Accessed 20 Nov 2020]

Environmental Protection Agency (EPA). (2014). Emission Factors for Greenhouse Gas Inventories. [Online]. Available from: https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf [Accessed 22 December 2020].

International Maritime Organization (IMO). (2014). Third IMO Greenhouse Gas study 2014. [Online]. Available from: https://glomeep.imo.org/wp-content/uploads/2016/06/GHG3-Executive-Summary-and-Report_web.pdf [Accessed 22 December 2020].

IPCC. (2018). Global Warming of 1.5°C. [Online]. Available from: https://www.ipcc.ch/sr15/ [Accessed 22 December 2020].

North Connect. (2018). 2018 HVDC Cable Planning Application and Marine License Documents: Chapter 9 Air Quality. [Online]. Available from: http://marine.gov.scot/sites/default/files/09_air_quailty_0.pdf [Accessed 22 December 2020].

ON&T. (2020). Rotech Subsea Completed Major Sand Wave Clearance and Cable Project. [Online]. Available from: https://www.oceannews.com/news/subsea-intervention-survey/rotech-subsea-completes-major-sand-wave-clearance-and-cable-project [Accessed 22 December 2020].

Rotech Subsea. (2020). TRS2 & RSG – Sandwave Clearance & Cable Recovery. {online]. Available from: https://www.rotech.co.uk/pdfs/C20-008_Global_Marine-TRS2_&_RSG-Sandwave_Clearance.pdf [Accessed 22 December 2020].

Smart Wind. (2015). Hornsea Offshore Wind Farm Project Two. Environmental Statement. Volume 5- Offshore Annexes. [Online]. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010053/EN010053-000374-7.5.1.6%20Cable%20Burial%20Plume%20Assessment.pdf [Accessed 22 December 2020].

UNFCCC. (2015) Paris Agreement. [Online]. Available from: https://unfccc.int/sites/default/files/english_paris_agreement.pdf [Accessed 22 December 2020].

UK Government. (2008). Climate Change Act 2008 (as amended). [Online]. Available from: https://www.legislation.gov.uk/ukpga/2008/27/contents [Accessed 22 December 2020].

UK Government. (2016). Carbon Budgets. [Online]. Available from: https://www.gov.uk/guidance/carbon-budgets [Accessed 22 December 2020].

UK Government. (2020). UK sets ambitious new climate target ahead of UN Summit. [Online]. Available from: https://www.gov.uk/government/news/uk-sets-ambitious-new-climate-target-ahead-of-un-summit [Accessed 22 December 2020].

11 Marine Sediment Quality

11.1 Introduction

This chapter provides an overview of the marine water quality likely to be present along and adjacent to the proposed Celtic Interconnector Project in the UK EEZ and considers the potential significant impacts that the installation and operation of the Celtic Interconnector may have on marine water quality, as well as the mitigation measures to be implemented to avoid, reduce, and offset any potential impacts.

This chapter deals with potential effects of changes to marine water quality arising from the installation of the Celtic Interconnector cable in the UK EEZ, including cable protection as required. However, marine water quality has the potential to be influenced by other receptors, such as sediment quality, and changes to marine water quality may subsequently cause effects on receptors covered in other chapters. Due to these interactions, this chapter should be read in conjunction with a number of other chapters in Volume 4 Environmental Report for UK Offshore, including:

- Chapter 13: Marine Water Quality;
- Chapter 12: Marine Physical Processes;
- Chapter 14: Biodiversity; and
- Chapter 20: Commercial Fisheries.

11.2 Methodology and Limitations

11.2.1 Legislation and Guidance

Key legislation relevant specifically to the assessment of potential effects on marine and coastal water quality includes:

- The Convention for the Protection of the Marine Environment of the North-East Atlantic (the "OSPAR convention") 1992 including; (i) the OSPAR Hazardous Substances Strategy; and (ii) Strategy for a Joint Assessment and Monitoring Programme (JAMP);
- The Marine and Coastal Access Act 2009 (MCAA), which provides a framework for the marine licensing system for works below the level of Mean High Water Springs (MHWS);
- The Marine Works (Environmental Impact Assessment) Regulations 2007 (2007 Regulations), as amended by The Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2017, which transpose the 2014/52/EU EIA Directive (amending the 2011/92EU Directive) into English and Welsh law;
- The Conservation of Species and Habitats Regulations 2017 (the Habitats Regulations), which implements EC Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (the Habitats Directive) in the UK;
- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019;

- The Water Framework Directive (WFD) 2000 (2000/60/EC), which was transposed into national law by means of the Water Environment (Water Framework Directive) (England and Wales) Regulations, 2003[6];
- The Marine Strategy Framework Directive (MSFD) (2008/56/EC);
- The Bathing Water Directive (BWD) 2006 (2006/7/EC);
- The Shellfish Waters Directive (SFWD) 2006 (2006/113/EC); and
- The Priority Substances Directive (2013/39/EU), amending the original Priority Substances Directive (2008/105/EC).

Section 63 of the Habitats Regulations states that an Appropriate Assessment is required for any plan or project, not connected with the management of a European site, which is likely to have a significant effect on a European site(s) either alone or in combination with other plans and projects. European sites subject to AA within the UK comprise Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar sites. The nearest European site in the UK EEZ is located approximately 23km from the Celtic Interconnector cable route. A Habitats Regulations Assessment (HRA) has been carried out for the Project and is presented in Volume 11.

The WFD and MSFD seek to ensure, respectively, Good Ecological Status and Good Environmental Status (GES) within designated water bodies. The MSFD covers waters beyond 1 nautical mile (nm) from the coast. The WFD is relevant to all freshwater, transitional and coastal waterbodies up to 1nm from the coast. The Project is planned to cross the UK Exclusive Economic Zone (EEZ), and will not enter UK 12nm territorial waters. However, there is the potential for effects on water quality arising as a result of the Project to be detectable in WFD waterbodies. Broadly, GES for the marine environment means that marine waters are:

- Ecologically diverse;
- Clean, healthy and productive; and
- Used sustainably, so that the needs of current and future generations are safeguarded.

The BWD and the SFWD are only applicable at designated bathing waters and shellfisheries, respectively. The Project does not intersect with any designated bathing waters or shellfisheries in the UK EEZ.

The Priority Substances Directive aims to control pollution caused by certain dangerous substances discharged to the aquatic environment. Two lists of compounds have been established. List I contains substances regarded as being particularly dangerous because of their toxicity, persistence and bioaccumulation and the discharge of which must be eliminated. List II contains substances which are less dangerous, but which nevertheless

[6] It is noted that the Water Framework Directive is directly applicable only to coastal waters, i.e. those within 1nm of land. However, as there is potential for activities associated with the Celtic Interconnector to affect such waterbodies, the WFD has been included here for completeness.

have a deleterious effect on the aquatic environment and the discharge of which must be reduced.

11.2.2 Desktop Studies

A hydro-sedimentary study was carried out by ACRI-HE in 2018/2019, which assessed the potential for sediment mobility induced by currents and waves along the Celtic Interconnector route, in areas where vibrocore samples were acquired and granulometry analyses were carried out.

Sediment chemistry samples were collected as part of the benthic surveys conducted along the cable route, as outlined in Section 8.2.3. Where appropriate, additional third-party information has been used to supplement these data, including peer-reviewed studies, and other, appropriate assessments. The references to these materials have been included as appropriate throughout this chapter. Information on projects with the potential to interact with the Celtic Interconnector on a cumulative level has been based on that presented in Chapter xxx.

Commented [A20]: Reference to be inserted

11.2.3 Field Studies

A number of marine and coastal surveys have been completed along the proposed cable route, with findings and wider reporting being provided by:

- CELTIC Interconnector Study Synthesis. Prepared by Wood Group for EirGrid & RTE. Doc Ref: 400584-PL-REP-001, Rev: H. July 2019.
- Celtic Interconnector Project. Volume 1 - Combined Inshore, Nearshore and Offshore Environmental Field Reports. Project No: 2015-001. Client Ref No: CELTIC-SUR1415-BEN-R01-V01 (BHM_2015-001). December 2015. Report prepared for EirGrid Plc and RTE by Bibby HydroMap and Benthic Solutions.
- Celtic Interconnector Project. Volume 2 - Combined Celtic Interconnector Habitat Assessment Survey and Environmental Baseline Report. Project No: 2015-001. Client Ref No: CELTIC-SUR1415-BEN-R02-V02 (BHM_2015-001). January 2016. Report prepared for EirGrid Plc and RTE by Bibby HydroMap and Benthic Solutions.
- Celtic Interconnector Project. Benthic Survey Report. Final report. Ref No: 2018-0019-016-BNT, Revision C3. September 2018. Report prepared for EirGrid Plc and RTE by Next Geosolutions.

With the exception of bathing and shellfish water areas, there are no existing monitoring programmes for concentrations of contaminants in marine waters, and no water samples were taken as part of the route survey for the Celtic Interconnector. However, benthic sediment samples were collected for chemical analysis, which can provide a useful indication for the quality and composition of adjacent marine waters.

11.2.4 Methodology for Assessment of Effects

Within this chapter a systematic approach to the assessment of effects has been followed where possible, which includes:

- A description of the relevant baseline conditions;
- A description of any proposed mitigation measures incorporated into the proposal;

- Identification and assessment of potential effects;
- Identification and assessment of cumulative effects (where appropriate); and
- Identification and assessment of residual effects remaining following the implementation of mitigation.

The assessment of effects on marine water quality broadly follows the methodology presented in Volume 4 Environmental Report for UK Offshore – Chapter 7: Assessment Approach. The evaluation and assessment within this chapter has been undertaken with reference to relevant parts of the 2010 guidelines for Ecological Impact Assessment in Britain and Ireland (Marine and Coastal), and 2018 Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland, both developed by the Chartered Institute of Ecology and Environmental Management (CIEEM). This is recognised as current best practice for ecological assessment and provides guidance to practitioners for refining their own methodologies.

The assessment considers, as appropriate: direct, indirect, secondary and cumulative impacts and whether the impacts and their effects are short, medium, long-term, permanent, temporary, reversible, or irreversible. The assessment of impacts then takes into account the baseline conditions to describe:

- How the baseline conditions will change as a result of the project and associated activities; and
- Cumulative and in-combination impacts of the proposal and those arising from other developments.

The significance of a potential impact is defined by the sensitivity of the receiving environment and the character of the predicted impact (Volume 4 Environmental Report for UK Offshore – Chapter 7: Assessment Approach). In some cases, magnitude or significance cannot be quantified with certainty; in these cases, professional judgement is used to identify the significance of an impact.

Despite it only being necessary to assess and report significant residual effects (those that remain after mitigation measures have been taken into account), it is good practice to make clear both the potential significant effects without mitigation and the residual significant effects following mitigation. This helps to identify necessary and relevant mitigation measures that are proportionate to the size, nature and scale of anticipated effects. Impacts are therefore considered initially in the absence of mitigation. After avoidance/mitigation measures and necessary compensation measures have been applied, and opportunities for enhancement incorporated, impacts are reassessed and residual impacts are identified.

In *Celtic Interconnector Technical Note detailing the proposed scope and content of the UK marine licence application and supporting Environmental Report (ER) and Assessments* (Wood 2021), three potential effects on marine water quality were identified. These were:

- Release of hazardous substances through loss of chemicals/fuels from installation vessels;
- Discharge of wastewater and solid waste (including plastics) from installation vessels; and

- Changes in water quality through release of contaminants held in marine and coastal sediments.

Vessels will manage on-board waste streams including wastewater and sewage in line with international agreements such as the International Convention for the Prevention of Pollution from Ships (the MARPOL convention), with Annex IV relating specifically to sewage management and Annex V relating to solid waste streams such as garbage. The potential effect ‘discharge of wastewater and solid waste (including plastics) from installation vessels’ has therefore been scoped out of this assessment.

11.3 Receiving Environment

As described above, with the exception of bathing and shellfish water areas, there are no existing monitoring programmes for concentrations of contaminants in marine waters, and no water samples were taken as part of the route survey for the Celtic Interconnector. Baseline information regarding marine water quality in the water column along the Project cable route has therefore been drawn from existing sources.

Water quality has the capacity to be affected through release of contaminants held in marine and coastal sediments when those sediments are disturbed. While water chemistry data are not available from the route surveys, detailed geophysical, geotechnical and benthic surveys were undertaken in the UK EEZ along the proposed cable route. These surveys included physico-chemical sampling of surficial sediments for particle size analysis (PSA), total organic carbon (TOC), total organic matter (TOM), heavy and trace metals and hydrocarbons. The results of these surveys as they pertain to baseline sediment quality are presented in Volume 4 Environmental Report for UK Offshore – Chapter 13: Marine Water Quality.

Marine water quality at any particular location is the result of a combination of source, transport and removal mechanisms for different individual chemical species. There are many routes by which substances with the potential to affect water quality enter the Celtic Sea, both through natural processes and as a result of anthropogenic activity, although there is evidence to suggest that anthropogenic inputs have reduced over the past few decades (UKMMAS, 2010).

Limited seawater quality data are available from the OSPAR Quality Status Report 2000 for Region III (Celtic Seas), an update of which is due in 2023. In general, the report indicates that inputs of potential contaminants, including metals, nutrients, and polychlorinated biphenyls (PCBs), were stable throughout the 1990s. With regard to metallic contaminants, lead (Pb) and mercury (Hg) are strongly associated with particulate material and therefore, except very close inshore and near to sources such as rivers, dissolved concentrations tend to be low. Copper (Cu), zinc (Zn) and cadmium (Cd) tend to stay in the dissolved phase, thus their concentrations tend to reflect much more closely mixing with oceanic seawater. The OSPAR report describes the concentrations of these dissolved metals in the Celtic Sea as being generally consistent with background levels, although in coastal areas (particularly estuaries) higher levels were recorded.

Turbidity provides a measure of Suspended Particulate Matter (SPM), both mineral and organic, in the water column. The organic fraction of SPM predominantly results from biological activity in the water column, and consists primarily of planktonic material and bacteria. This will not be influenced by any activities associated with cable installation and will not be discussed further in this Chapter. Inorganic SPM, which includes suspended sediments, results from inputs from rivers (derived both from erosion in the river catchments and from chemical reactions in the estuarine zone), fallout from the atmosphere, and coastal erosion combined with resuspension of existing sediments and chemical reactions in the water column. As a result, inorganic SPM loads vary widely, generally increasing with proximity to the coastline. SPM concentrations are highly variable, both spatially and temporally, depending on proximity to terrestrial sources, water depth, and weather conditions (UKMMAS 2010).

SPM loads are also highly dependent on near-bottom current speeds, with higher speeds resulting in more resuspension of sediments. As a result, SPM loads tend to be greater during spring tides than during neaps and can increase to very high levels during storm events (UKMMAS 2010). Satellite imagery data (Rivier *et al*., 2012; Cefas, 2016) indicate seasonality, with non-algal surface SPM concentrations in the Celtic Sea being generally very low (< 1mg/l) except in winter, when monthly-averaged values of up to around 5 mg/l have been observed.

As a general indication of naturally occurring SPM loads resulting from sediment resuspension, values in the order of 1,000mg/l have been measured in the surf zone of sandy beaches (Voulgaris and Collins, 2000), while surface inorganic SPM loads in water depths of over 70m in the central English Channel may exceed 6mg/l during the winter (Rivier *et al*., 2012).

The baseline environment is not static and will exhibit some degree of natural change over time, with or without the Project in place, due to naturally occurring cycles and processes. Therefore, when undertaking impact assessments, it is necessary to place any potential impacts in the context of the envelope of change that might occur naturally over the timescale of the Project.

Further to potential change associated with existing cycles and processes, it is necessary to take account of the potential effects of climate change on the marine environment. Mean sea level is likely to rise during the 21st Century as a consequence of either vertical land (isostatic) movements or changes in eustatic sea level. A rise in sea level may allow larger waves, and therefore more wave energy, to reach the coast in certain conditions and consequently result in an increase in local rates or patterns of erosion and the equilibrium position of coastal features. It is however unlikely that significant changes in the level of contaminants in the Celtic Sea will occur as a result. In addition, there is a high degree of uncertainty how winter storm tracks over the North Atlantic Ocean may be altered due to climate change. Natural variability in wind speeds and hence wave heights is large and dominant and is projected to remain so for the century to come (Gallagher *et al*., 2016).

11.4 Characteristics of the Development

Volume 4 Environmental Report for UK Offshore – Chapter 5: Project Description provides a detailed account of the Project including works to be conducted in the marine environment.

The installation of the Celtic Interconnector will cause disturbance to the seabed, with resulting effects on marine water quality in the immediate vicinity. The mechanisms by which this will occur are described in the following sections.

11.4.1 Cable Route

The cable route within the UK EEZ passes approximately 30km to the west of the Isles of Scilly and approximately 75km to the west of Land's End on the UK mainland, covering a distance of approximately 211km in water depths of 80-100m.

The installation of the submarine cable as part of the marine construction works will typically follow a sequence similar to the following:

- Contractor survey, route engineering and finalisation;
- UXO intervention campaign (if required);
- Boulder clearance;
- Sandwave pre-sweeping;
- Pre-lay grapnel runs;
- Construction of infrastructure crossings;
- Pre-lay route survey;
- Cable lay and post-lay survey; and
- Burial and post-burial survey.

Commented [A21]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

Installation of the cable will be undertaken using methods including (as appropriate to local seabed conditions) ploughing, jetting and mechanical trenching. Optimum burial depths of 0.8m to 2.5m are sought for the cable; where this is not possible, appropriate external cable protection shall be installed.

There is the potential for marine water quality to be impacted by any activity which causes disturbance of the seabed along the route through release of contaminants held in surficial sediments. However, changes in marine water quality arising from seabed disturbance is only a risk in heavily contaminated locations. Sediment samples collected as part of cable route surveys in 2015 and 2018 indicate that the seabed along the cable route in the UK EEZ is not contaminated (Volume 4 Environmental Report for UK Offshore – see Chapter 13: Marine Water Quality). Surveys of the cable route (i.e. pre-lay, post-lay and post-burial) will not cause significant resuspension of seabed sediments.

During preparatory works, activities likely to cause disturbance of the seabed include boulder removal and sandwave sweeping. During construction works, pre-lay grapnel runs, construction of infrastructure crossings, cable lay and cable burial all are likely to cause seabed disturbance.

The presence of installation vessels during marine construction works and surveys will marginally increase the risk of a pollution incident, which has the potential to negatively impact marine water quality. The running aground of a vessel or a collision could lead to a fuel spill. In addition, cleaning fluids, oils and hydraulic fluids used onboard cable laying vessels could be spilled overboard or unintentionally discharged. However, a pollution incident would only occur in case of an accident, and is therefore considered an unlikely effect.

11.4.2 Cable Protection

For those areas where the optimum burial depth cannot be achieved, external cable protection will be installed. The primary external protection approach is through rock placement (Volume 4 Environmental Report for UK Offshore - Chapter 5: Project Description). However, a number of other options could be considered, notably concrete mattressing. Rock placement would be sourced from certified quarries, with well-developed infrastructure.

The requirement for external cable protection will be established during the detailed design phase. The exact length of the route which will need this additional protection is therefore not known at the time of writing. For the purposes of assessing potential effects, a precautionary approach has been employed and it has been assumed that the whole length of the cable route within the UK EEZ (i.e. 211km) will be protected. As a 'worst case scenario' it has been assumed that cable protection will be installed in a 15m wide corridor centred on the actual cable, resulting in an area of approximately 3.2km^2 covered by external protection. However, external protection will only be required in areas where trenching is not deemed feasible, through either the presence of other seabed assets or obstacles (such as at cable crossings), where ground conditions are too hard, or where secondary protection is required to achieve the required burial depth.

Introduction of hard material into an area which is predominantly sedimentary has the potential to result in localised changes to hydrographic conditions, and associated sediment dynamics. It is anticipated that some level of scour may occur where external cable protection is installed. However, due to the intrinsic purpose of the cable protection, the protection will be designed to minimise scour.

Scour of seabed sediments around the cable protection has the potential to cause changes in marine water quality through release of contaminants held in benthic sediments. In addition, the presence of installation vessels during marine construction works and surveys will marginally increase the risk of a pollution incident, which has the potential to negatively impact marine water quality. The running aground of a vessel or a collision could lead to a fuel spill. In addition, cleaning fluids, oils and hydraulic fluids used onboard cable laying vessels could be spilled overboard or unintentionally discharged. However, a pollution incident would only occur in case of an accident, and is therefore considered an unlikely effect.

11.5 Likely Significant Impacts of the Development

11.5.1 Do Nothing

In the 'Do Nothing' alternative, there would be no marine construction works associated with the Celtic Interconnector, and therefore the existing baseline environment would be expected to remain unchanged, subject to natural variation. The evolution of the marine environment in the absence of the Project will depend on future levels of marine activity such as military operations and offshore developments, future resource exploitation such as fishing, and the effectiveness of protected site management, as well as variation due to climate change. Some of these possible changes may be planned, such as marine renewable energy developments and cables. Others, however, will be subject to change such as the evolution of commercial fishing activities as influenced by economic and resource availability factors, the evolution of maritime traffic as influenced by economic and port related factors, and the evolution of maritime fleets as influenced by on-board waste management practices.

11.5.2 Installation Phase

Commented [A22]: Section to be updated with additional subheadings to help readability.

During the installation phase of the Celtic Interconnector, surficial sediments will be disturbed along the marine cable route. Seabed sediments will be resuspended into the water column increasing turbidity and creating sediment plumes that can have an effect, either positive or negative, on habitats and species (Dernie *et al*., 2003) (see Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity).

Compared to other offshore activities such as bottom trawling, ship anchoring or large-scale dredging, seabed disturbance resulting from subsea cable activities is considered temporary and has a relatively limited extent (Carter *et al*., 2009; OSPAR, 2012), with the seabed usually returning to its original state (BERR, 2008). The disturbance itself is restricted to a narrow strip of seabed, normally limited to an area 2-3m either side of the cable (Bald *et al*., 2014; Carter *et al*., 2009), or in the order of 10m width if the cable has been ploughed into the seabed (OSPAR, 2009).

Installation tools may have a footprint up to 10m width depending on the burial method used (OSPAR, 2009; NIRAS, 2015). The level of seabed disturbance caused during clearance or installation also largely depends on the equipment being used, as well as on the sediment type (BERR, 2008). The level of disturbance caused by ploughs is considered to be lower compared to jetting techniques (OSPAR, 2012; NIRAS, 2015).

Dispersion of disturbed sediments is dictated by the local hydrodynamic regime, particularly near-bottom current speeds (BERR, 2008). Coarser sediments such as sand and gravel settle relatively close to the origin of disturbance, while finer sediments such as clay and silt can remain in suspension for a longer period of time creating a larger impact footprint. However, a greater dispersion also results in a smaller level of deposition at any given point. The majority of sediment deposition occurs within tens of meters of the cable route (OSPAR, 2009). Previous studies (e.g. Aquind, 2019) have stated that clays (i.e. sediments <3.9µm diameter) have the capacity to be transported distances of up to 10km, although at these distances it is unlikely that that increases in suspended sediment loads will be discernible above natural variation.

In addition to causing increases in turbidity, the installation phase has the potential to release/remobilise contaminants held within the sediment when the seabed is disturbed (BERR, 2008). The location and type of sediment will determine whether contaminants are likely to be held in the benthic environment.

Contaminants such as oil and heavy and trace metals are most likely found near the coastline, generally attached to fine sediments, although certain chemicals can persist in coarser sediments (BERR, 2008). Contaminant release is therefore only a concern in heavily contaminated locations, such as major ports, oil and gas developments, historical industrial areas, and waste disposal or natural sinks, and is of less importance when considering offshore areas (OSPAR, 2009).

The majority of organic compounds present in the environment are either readily biodegradable or of low water solubility and hence of limited significance in terms of water contamination (Tran *et al*., 1996). However, some organic compounds can reach toxic concentrations in the dissolved phase, and/or bioaccumulate from the dissolved phase to toxic levels. These include organo-metallic compounds of lead, tin and mercury.

The release of contaminants usually occurs within a localized area for a short period of time during the installation (and potentially during any maintenance activities or decommissioning), and should only be of concern near industrialised areas (BERR, 2008). Sediment samples collected as part of cable route surveys in 2015 indicate that the seabed along the cable route in the UK EEZ is not contaminated (see Volume 4 Environmental Report for UK Offshore - Chapter 13: Marine Water Quality). Furthermore, bioavailable metals and hydrocarbons are generally associated with finer sediments (i.e. muds, <63µm) and higher organic carbon content. As the surficial sediments along the interconnector cable route are predominantly sands with low associated total organic carbon (TOC) values, the risk of re-suspension and subsequent desorption of contaminants is lower than in very muddy sediments.

The cable burial technique used in the UK EEZ may vary depending on the geology of the seabed. However, assuming that a corridor of approximately 15m width will be disturbed by cable-laying equipment along a length of 211km (in the UK EEZ) an area of approximately 3.2km^2 will be directly disturbed by cable installation.

The cable route does not pass through any habitats or areas of environmental sensitivity (ie no designated sites, or supporting environments for mobile qualifying features of nearby designated sites), therefore receptor value for water quality is considered to be low to negligible. The geographic extent of any increase in SPM concentrations due to cable burial is not expected to extend more than 10km away from the installation area, with the majority of particles (over 90%) being deposited within 1km. It is therefore considered that coastal WFD waterbodies and waters covered by the SFWD and BWD will not be affected. The area with the potential to be affected by increases in SPM is small within the wider setting of the UK EEZ, resulting in a low magnitude of change. Any elevation in suspended sediment concentrations once installation works are complete will be temporary, with levels expected to return to baseline within a single spring-neap tidal cycle. Effects on marine water quality due to changes in turbidity are therefore considered to be not significant.

Contamination arising from seabed disturbance is only a risk in heavily contaminated locations (OSPAR, 2009). Sediment samples collected as part of cable route surveys indicate that the seabed along the cable route in the UK EEZ is not contaminated. Sediments which are suspended due to cable burial are not expected to settle out more than 10km away from the installation area, with the majority (>90%) being deposited within 1km. It is therefore considered that coastal WFD waterbodies and waters covered by the SFWD and BWD will not be affected. As receptor value is low to negligible, and magnitude of change is expected to be low, changes in water quality through release of contaminants held in marine and coastal sediments are considered to be not significant.

Installation of cable protection has the potential to impact marine water quality via the release of hazardous substances through loss of chemicals/fuels from installation vessels. The marine environment is highly sensitive to hydrocarbon and chemical spills, which can have major ecological effects. The magnitude of the potential effect is low to high and is dependent on the nature and size of a spill. Mitigation measures are therefore required to remove the risk of accidental hydrocarbon or chemical spill. Overall, a hydrocarbon or chemical release is considered unlikely as the presence of cable installation vessels will only marginally increase the risk of a pollution incident. Effects on marine water quality due to loss of chemicals / fuels from installation vessels are therefore considered to be not significant.

The potential for indirect effects on ecological features arising from changes to water quality along the cable route is presented in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity.

11.5.3 Operational Phase

Once the cable and its associated infrastructure are installed and operating, it is anticipated that they will require minimal maintenance. However, in the event of the cable getting damaged or becoming faulty, operational maintenance activities would be required to repair the affected components. For offshore components, the cable may need to be cut at the appropriate location and brought to the surface for repair before being put back into place on the seabed or replaced. Operational maintenance activities would typically comprise similar vessels, activities and locations as the installation works.

Sediments are likely to be disturbed during cable maintenance activities, and effects are considered to be the same as for the installation phase.

The cable route does not pass through any habitats or areas of environmental sensitivity, therefore receptor value for water quality is considered to be low to negligible. The geographic extent of any increase in SPM concentrations due to cable burial is not expected to extend more than 10km away from the installation area, with the majority of particles (over 90%) being deposited within 1km. It is therefore considered that coastal WFD waterbodies and waters covered by the SFWD and BWD will not be affected. The area with the potential to be affected by increases in SPM is small within the wider setting of the UK EEZ, resulting in a low magnitude of change. Any elevation in suspended sediment concentrations once installation works are complete will be temporary, with levels expected to return to baseline within a single spring-neap tidal cycle. Effects on marine water quality due to changes in turbidity are therefore considered to be not significant.

Contamination arising from seabed disturbance is only a risk in heavily contaminated locations (OSPAR, 2009). Sediment samples collected as part of cable route surveys indicate that the seabed along the cable route in the UK EEZ is not contaminated. Sediments which are suspended due to cable burial are not expected to settle out more than 10km away from the installation area, with the majority (>90%) being deposited within 1km. It is therefore considered that coastal WFD waterbodies and waters covered by the SFWD and BWD will not be affected. As receptor value is low to negligible, and magnitude of change is expected to be low, changes in water quality through release of contaminants held in marine and coastal sediments are considered to be not significant.

Use of vessels during maintenance works has the potential to impact marine water quality via the release of hazardous substances through loss of chemicals/fuels. The marine environment is highly sensitive to hydrocarbon and chemical spills, which can have major ecological effects. The magnitude of the potential effect is low to high and is dependent on the nature and size of a spill. Mitigation measures are therefore required to remove the risk of accidental hydrocarbon or chemical spill. Overall, a hydrocarbon or chemical release is considered unlikely as the presence of cable maintenance vessels will only marginally increase the risk of a pollution incident. Effects on marine water quality due to loss of chemicals / fuels from vessels are therefore considered to be not significant.

The potential for indirect effects on ecological features arising from changes to water quality along the cable route is presented in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity.

11.5.4 Decommissioning Phase

A decommissioning plan will be prepared prior to the decommissioning phase of the proposed development, which is expected to be at least 40 years from the start of operation. It is currently anticipated that the cable and associated external cable protection will be left in-situ where this is deemed environmentally acceptable; this may require a level of long-term monitoring and maintenance. There are not expected to be any effects on marine sediment quality and sediments as a result of this proposed course of action. However, any works required for decommissioning will be subject to future consent applications, and environmental assessments, as relevant.

11.5.5 Cumulative Effects

There are currently no other developments with the potential likely to cause cumulative impacts with the Project in the UK EEZ.

11.6 Mitigation and Monitoring

Commented [A23]: Placeholder: All mitigation and monitoring measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

11.6.1 Installation Phase

In line with guidelines outlined in BERR (2008) and OSPAR (2012), the cable route has been designed to avoid European designated sites including SACs and SPAs and thus minimise any potential effects to areas of conservation importance.

During the pre-construction engineering and design phase for the Celtic Interconnector, a detailed analysis of the seabed along the route of the Celtic Interconnector will be undertaken. From this, the most appropriate installation techniques will be established, as determined by seabed type, to minimize sediment disturbance and hence minimise effects on marine water quality. In addition, where external cable protection is required, this will be designed according to seabed type, again, minimizing sediment and seabed disturbance. Minimising seabed disturbance will minimise the potential resuspension of contaminants from seabed sediments to the water column.

Where the need for external rock protection is identified, this will be designed according to the receiving environment, based on seabed type, and the need to reduce seabed disturbance. Cable protection will be designed to minimise scour, and hence resuspension of sediments. Rock placement would be sourced from certified quarries, with inert natural stone material used to minimise the degree of impact.

Vessels used for installation will be expected to be compliant with MARPOL regulations. These regulations cover the prevention of pollution from accidents and routine operations. In addition, mitigation measures will be taken to minimise the risk of collision between installation vessels and other vessels. All vessels will have shipboard oil pollution emergency plans (SOPEP) in operation.

11.6.2 Operational Phase

Throughout the Project's lifespan, periodic monitoring of the cable route will be undertaken; should such monitoring identify significant changes in the bathymetry or seabed features (i.e. sediment type) in the vicinity of the cable route, appropriate measures will be taken, including replacement or addition of further external cable protection, as necessary.

Vessels used for any monitoring or maintenance activities during the operation phase of the Project will be expected to be compliant with MARPOL regulations. These regulations cover the prevention of pollution from accidents and routine operations. In addition, mitigation measures will be taken to minimise the risk of collision between installation vessels and other vessels. All vessels will have shipboard oil pollution emergency plans (SOPEP) in operation.

11.6.3 Residual Impacts

No significant residual effects on marine physical processes are anticipated.

11.7 References

Aquind Limited (2019). Aquind Interconnector Environmental Statement, November 2019.

Bald, J., Hernández, C., Galparsoro, I., Germaán Rodrigues, J., Muxika, I., Enciso, Y.T. and Marina, D. (2014). Environmental impacts over the seabed and benthic communities of submarine cable installation in the Biscay marine energy platform. Proceedings of the 2nd international conference on environmental interactions of marine renewable energy technologies (EIMR2014622), 28 April – 02 May 2014, Stornoway, Isle of Lewis, Outer Hebrides, Scotland.

BERR (2008). Department for Business Enterprise & Regulatory Reform. Review of cabling techniques and environmental effects applicable to the offshore wind farm industry. Technical Report. January 2008.

Carter, L., Burnett, D., Drew, S., Marle, G., Hagadorn, L., Bartlett-McNeil, D. and Irvine, N. (2009). Submarine cables and the oceans: connecting the world. UNEP-WCMC Biodiversity Series No. 31. ICPC/UNEP/UNEP-WCMC, 64pp.

Dernie, K.M., Kaiser, M.J. and Warwick, R.M. (2003). Recovery rates of benthic communities following physical disturbance. *Journal of Animal Ecology*, 72(6): 1043-1056.

Gallagher, S., Gleeson, E., Tiron, R., McGrath, R., and Dias, F. (2016). Twenty-first century wave climate projections for Ireland and surface winds in the North Atlantic Ocean, *Adv. Sci. Res*., 13: 75-80

NIRAS Consulting Ltd (2015). Renewables Grid Initiative Subsea Cable Interactions with the Marine Environment: Expert review and Recommendations Report.

OSPAR (2000). Quality Status Report Region III Celtic Seas. OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic.

OSPAR (2009). Assessment of the environmental impacts of cables. OSPAR Commission. 19 pp.

OSPAR Convention (2012). Guidelines on Best Environmental Practice (BEP) in Cable Laying and Operation (Agreement 2012-2). (Source: OSPAR 12/22/1, Annex 14).

Rivier, A., Gohin, F., Bryère, P., Petus, C., Guillou, N. and Chapalain, G. (2012). Observed vs. predicted variability in nonalgal suspended particulate matter concentration in the English Channel in relation to tides and waves Geo Marine Letters 32 pp 139-151

Tran, K., Yu, C.C. and Zeng, E.Y. (1996). Organic pollutants in the coastal environment off San Diego, California. 2. Petrogenic and biogenic sources of aliphatic hydrocarbons. *Environmental Toxicology and Chemistry*, 16(2): 189-195.

Voulgaris, G. and Collins, M.B. (2000). Sediment resuspension on beaches: Response to breaking waves. Marine Geology. 167.

UKMMAS (2010). Charting Progress 2. An assessment of the state of UK seas. Available at: https://tethys.pnnl.gov/sites/default/files/publications/UKMMAS_2010_Charting_Progress_2.pdf [Accessed January 2021].

12 Marine Physical Processes

12.1 Introduction

This chapter considers the potential for effects to arise on physical coastal processes, and sediments, associated with the proposed Celtic Interconnector Project in the UK EEZ. Marine physical processes is a wide-ranging discipline, with the capacity to interact with a number of other disciplines. This chapter deals with potential effects of changes to marine processes arising from the installation of the Celtic Interconnector cable, and cable protection as required. These changes may subsequently cause effects on receptors covered in other chapters. Due to these interactions, this chapter should therefore be read in conjunction with a number of other chapters in Volume 4 Environmental Report for UK Offshore, as follows:

- Chapter 11: Marine Sediment Quality;
- Chapter 13: Marine Water Quality; and
- Chapter 14: Biodiversity.

12.2 Methodology and Limitations

12.2.1 Legislation and Guidance

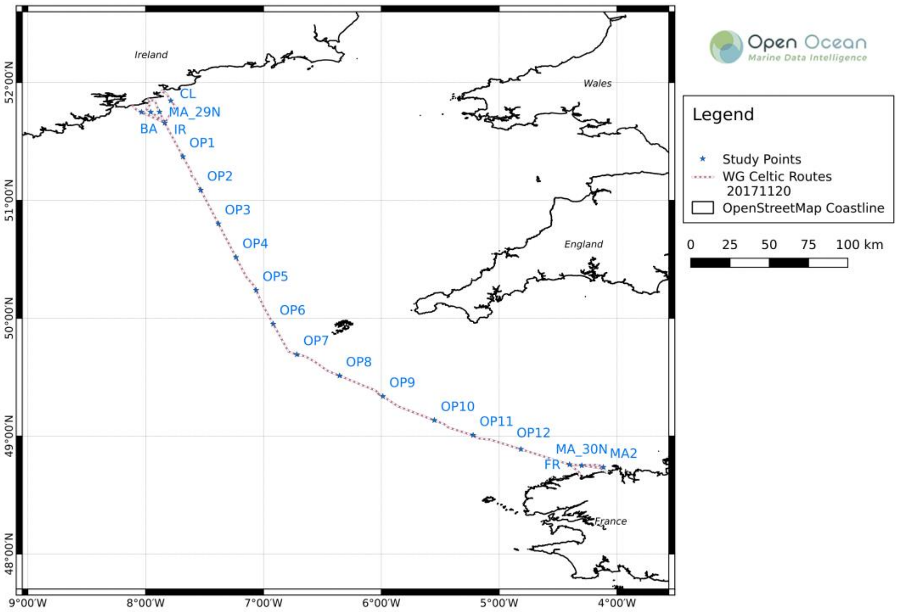
There is no specific legislation or guidance directly associated with the assessment of effects on marine physical processes in the UK EEZ. As described above, the marine physical processes topic covers a range of aspects, with the potential to interact and affect other disciplines, including biodiversity and marine water and sediment quality. Assessment of effects addressed under those topics has been conducted in relation to the appropriate guidance.

At a wider level, marine physical processes form part of the consideration for the Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (the Marine Strategy Framework Directive (MSFD)). Elements directly associated with this directive (for example, 'Seafloor Integrity', one of the eleven Descriptors outlined in the MSFD) have been considered where appropriate as potential effects within this assessment, with more detailed assessment from a directive perspective in Volume 10C - MSFD Assessment.

12.2.2 Desktop Studies

Hydrographic parameters including wind speeds, significant wave heights and current speeds were derived from existing metocean databases (including the Climate Forecast System data base, produced by the National Center for Environmental Prediction, and the HOMERE wave database, developed under the Integrated Ocean Waves for Geophysical and other Applications (IOWAGA) framework). A hydro-sedimentary assessment was also undertaken to assess the potential for sediment mobility induced by currents and waves along the whole cable route. Two metocean studies were produced, including detailed current modelling for the nearshore zone. This built on data calculated at 20 study points along the full length of the cable route (and eight specifically within the UK EEZ), identified to represent subareas along the cable route. The location of all study points are presented in Figure 12.1.

Figure 12.2 Study points used to inform metocean study for the Project



Where appropriate, additional third-party information including scientific papers and associated published research (as referenced throughout chapter) has been used to supplement the data gathered by site-specific field surveys.

12.2.3 Field Studies

A number of surveys were completed along the length of the cable route in the UK EEZ, covering the cable route itself, and a 500m wide corridor, during 2017 and 2018. These include completion of:

- multibeam echo sounder survey, processed to provide a digital terrain model identifying major bathymetric features and bathymetric changes on the seabed, including mega-ripples and seabed infrastructure;
- side-scan sonar, run at both high and low frequency with digital rendering onto a seabed mosaic of the area, allowing inference of seabed type, hardness, and delineation of low-level relief features and discrete objects; and
- shallow sub-bottom profiling, used to clarify changes that might be seen in the sonar and surface bathymetry.

12.2.4 Methodology for Assessment of Effects

In broad terms, the assessment of effects on marine physical processes and sediments is aligned with that presented in Chapter 7: Assessment Approach. However, due to the nature of the receptors covered within this assessment, the establishment of numerical scales for status of receptors in terms of importance and sensitivity, and for effects in terms of magnitude, are not appropriate. Such scales are applied in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity when considering effects of changes in marine physical processes on biodiversity, and in Volume 4 Environmental Report for UK Offshore - Chapter 13: Marine Water Quality for potential changes to water quality.

12.2.5 Difficulties Encountered

No notable difficulties were encountered in the development of this chapter.

12.3 Receiving Environment

The field of marine physical processes considers the natural cycle of tides, currents, wave climate and the resulting sediment regime. Installation and placement of structures on the seabed has the potential to influence the flow of water and the associated characteristics of waves and currents, thus potentially altering the sedimentary regime. In general, as waters deepen, the Project is outside the influence of localised changes in coastal activities that might affect physical processes at the seabed and effects of surface waves and swells become proportionally less important in deeper water.

12.3.1 Wind and wave conditions

Spatial variations in wind and wave conditions were recorded along the length of the cable route, with an average wind velocity greater than 8m/s along most of the route. In general, the western UK section of the Celtic Interconnector cable route is characterised by weak currents and tides, and high exposure to swells, and strong winds. The strength of currents and tides increases in the English Channel, although there is still a high level of exposure to swell, and strong winds. The highest wave heights along the cable route occur west of the Isles of Scilly, where maximum significant wave heights (Hs) of up to 14.7m have been recorded.

Highly energetic swell coming westerly from the Atlantic Ocean results in harsh wave conditions. Due to the prevailing wind conditions, the main direction of the overall sea state has a west-south-west incidence, with these winds tending to create higher wind sea waves than those towards the French coast.

There is strong seasonal variation along the cable route, with stronger winds during winter (maximums from December to February) and weaker during summer (June to August).

12.3.2 Sea level

The highest positive storm surges (where wind and tide combine to raise sea surface levels above the normal range) occur during winter, with stronger winds blowing in from the south-west. The lowest negative storm surges, where the sea surface level is depressed, occur during spring, when winds from the north-east / east-north-east become stronger. This shift in prevailing peak wind directions tends to accentuate ebb tides and attenuate flood tides, also contributing to overall lower negative storm surge.

12.3.3 Currents

Tidal currents are strongest along the cable route during the equinoxes in spring and autumn. In the western half of the cable route, depth-averaged current magnitudes are less than 0.25m/s, and decrease towards the Irish shoreline, while in the eastern half of the route, depth-averaged currents increase from 0.3m/s near the Isles of Scilly to around 0.4m/s at the boundary with the French EEZ. The main current directions are dictated by the ebb and flow tidal conditions and follow a west-south-west and east-north-east axes along most of the cable route. Currents accelerate around the Isles of Scilly, resulting in increased levels of superficial sediment mobility being induced by currents (70-90%), rather than wave action.

12.3.4 Seabed conditions

A detailed description of seabed sediments is provided in Volume 4 Environmental Report for UK Offshore - Chapter 11: Marine Sediment Quality. At a general level, the nature of the seabed sediment along the entire cable route is predominantly fine to coarse sands, with occasional gravel and pebbles, with the dominant sediment type represented by gravelly muddy sand, according to the Folk classification. Within the UK EEZ, bathymetry varies between ~80m and ~110m, with a number of mobile sediment features present, including sand ripples and other features reaching approximately 1-2m above the seabed. In exceptional cases, where sand waves have merged, larger features reaching up to 6m above the seabed have been recorded. In areas of high energy in the offshore zone throughout the entire cable route’s length, areas of mega-ripples have been recorded, generally oriented north-south, with coarser sediments associated with steeper gradients on the leeward side of the features.

Evidence of boulders was recorded throughout the survey corridor, including within the UK EEZ, often with shallow depressions produced by scour associated with them. For the majority of the cable route within the UK EEZ though, the mean particle size of sediments recorded was <3mm.

12.4 Characteristics of the Development

As outlined in Volume 4 Environmental Report for UK Offshore - Chapter 5: Project Description, by its very nature, the installation of the Celtic Interconnector Project, and associated cable protection, will inevitably result in a level of disturbance to the seabed, with resulting effects on marine physical processes in the immediate vicinity. During preparatory works, this may include removal of boulders from the cable route and sand wave sweeping.

Installation of the cable will be undertaken using various methods including, as appropriate to local seabed conditions, ploughing, jetting and mechanical trenching. Optimum burial depths of 0.8-2.5m are sought for the cable; where the required depth is not achieved, remedial (secondary) external cable protection shall be installed.

12.5 Likely Significant Effects of the Development

12.5.1 Do Nothing

In the Do Nothing alternative, there would be no subsea works along the proposed route of the Celtic Interconnector cable in the UK EEZ, in relation to the Project. However, over the estimated lifetime of the proposed development, changes to marine hydrological changes may occur as a result of climate change, with associated changes in marine sedimentary processes. At this stage, the degree of predicted change cannot be quantified.

12.5.2 Construction Phase – Cable Installation

Disturbance to, and loss of, seabed features during cable installation

During the installation phase of the Celtic Interconnector Project, the surficial sediments and associated features, such as sand waves or mega-ripples, along the cable route will be disturbed and may be permanently lost as a result of seabed preparation and the physical laying of the cable. Based on an assumption that a corridor of approximately 15m (0.015km) will be disturbed by cable-laying equipment, in the UK EEZ, along a length of 211km, an area of 3.2km^2 will be directly disturbed by cable installation. Depending on the installation method used, the trench created by installation will be partly or fully back-filled by the cable-laying equipment.

Where external cable protection is not installed, the trenches will be naturally infilled along the majority of the cable route, through a combination of natural collapse of temporary trench walls, the resettling of disturbed suspended sedimentary material and bioturbation (the natural movement / disturbance of sediment by organisms including, for example, burrowing worms). In such areas, effects on seabed features are considered to be temporary, and following natural infilling, the seabed will return to a similar condition as it was pre-installation.

The cable route does not pass through any habitats or areas of environmental sensitivity, therefore receptor value for the seabed features is considered to be low. As described above, the area of seabed with potential to be affected by temporary disturbance is small within the wider setting of the UK EEZ, resulting in a low magnitude of change. Effects as a result of disturbance to, and loss of, seabed features are therefore assessed as not significant.

The potential for indirect effects on ecological features arising from physical sediment disturbance along the cable route is presented in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity.

Impacts of Unexploded Ordnance

Although surveys have suggested there is a low risk of encountering unexploded ordnance (UXO), as presented in Volume 4 Environmental Report for UK Offshore - Chapter 5: Project Description, if such a target is identified, the preference will be avoidance by localised re-routing. If this is not possible there are a number of options for its safe removal and/or detonation. In terms of potential effects on the seabed of the cable route, the worst case would be for the target to be detonated *in situ*, where it is found. Depending on the size of the target, this could result in damage to the surrounding marine environment, including loss of habitats and seabed features. However, at the time of writing, the presence of UXO along the route is not considered likely, and should any targets be identified, these would be reviewed and disposed of through liaison with the appropriate authorities, including, if required, completion of any additional impact assessment required at the time.

Commented [A24]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

12.5.3 Construction Phase – Installation of Cable Protection

Disturbance to, and loss of, seabed features during installation of cable protection

For those areas where the optimum burial depth cannot be achieved (either due to seabed conditions, or the presence of, for example, other subsea cables), external cable protection will be installed, using either rock protection or cable mattressing, as appropriate, and as presented in Volume 4 Environmental Report for UK Offshore - Chapter 5: Project Description. The requirement for external cable protection will be established during the detailed design phase, therefore at the time of writing, the exact length of the route that will need this additional protection is not known. However, an initial estimate has been made, and it has been assumed that cable protection will be installed either side of the actual cable, resulting in a 15m (0.015km) wide corridor. Based on current understanding of the seabed along the cable route, a worst case of up to 80km of cable within the UK EEZ will require external cable protection. This results in an area of 1.2km^2 covered by external protection.

Installation of external rock protection has the potential to change the local nature of the seabed from sedimentary to harder substrate. However, as outlined above, external protection will only be required in areas where optimum burial depth cannot be achieved. This may arise through either the presence of other seabed assets / obstacles (such as at cable crossings), where ground conditions are too hard, or where secondary protection is required to achieve the required burial depth.

In these latter areas, installation of external rock protection will result in the addition of hard substrate into areas where such conditions already exist. There will therefore be no significant change to the seabed types present. Where external rock protection and/or mattressing is installed over cable crossings, or as secondary protection, there is the potential for permanent loss of seabed features in sedimentary environments. However, as described above, this is anticipated to be over a small area (a maximum of 1.2km^2) when compared to the availability of similar seabed features in the wider marine environment.

The cable route does not pass through any habitats or areas of environmental sensitivity, therefore the receptor value for seabed features is assessed as low to negligible. The area of seabed permanently changed in nature will be of low magnitude compared with the existing extent of these features. Effects on seabed features as a result of installation of external rock protection are therefore assessed as minor in magnitude and therefore not significant.

The potential for indirect effects on ecological features arising from physical sediment disturbance along the cable route is presented in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity.

12.5.4 Operational Phase – Presence of Cable Protection

Changes to bathymetry through placement of external cable protection

In the UK EEZ, the water reaches a maximum depth of over 110m, never becoming shallower than ~80m. Throughout the majority of the route, the cable will be buried at a minimum depth of 1m below the seabed surface, therefore is not anticipated to have any effect on local bathymetry in terms of seabed features or overall water depth.

External cable protection will be installed only in areas where optimum burial depth cannot be achieved, or where obstacles and/or cable crossings are required; this is not expected to be the case for the full length of the route. However, as above, for the assessment of effects, the precautionary assumption that rock protection will be required along the full cable route has been made. As a result, there may be the need to install external rock protection along the length of the cable, up to approximately 1m ‘deep’, and proud of the seabed surface. As described above, the UK seabed displays a range of features, including ridges, occasional depressions, and mobile sediment features such as sand ripples. As a result, the introduction of a feature up to 1m in height is unlikely to result in a significant change to the seabed. Overall water depth is also not expected to be affected significantly, due to the water depths recorded along the route having a minimum value of ~80m.

Effects on bathymetry through placement of external cable protection are therefore assessed as minor in magnitude and therefore not significant.

12.5.5 Changes to local sediment dynamics through the presence of external cable protection

Introduction of hard material into an area that is predominantly sedimentary has the potential to result in localised changes to hydrographic conditions and associated sediment dynamics. As described above, the seabed along the route of the Celtic Interconnector cable exhibits a number of features, including mobile sand ripples and waves.

Studies along the cable route corridor have shown, however, that sediment mobility in the vicinity of the Celtic Interconnector cable route is very low, with a low risk of scour occurring. Scour protection, where deployed, will be designed in such a way to minimise the risk of scour, and should temporary scour occur in the area, this is likely to be infilled naturally, albeit at a low rate, from the surrounding sediment.

As noted above, no environmentally sensitive habitats (ie those designated as being of conservation importance, or supporting qualifying features of designated sites) were recorded along the cable route, and low levels of scouring are anticipated. Effects on local sediment dynamics through the presence of external cable protection are therefore assessed as minor in magnitude and therefore not significant.

12.5.6 Decommissioning Phase

A decommissioning plan will be prepared prior to the decommissioning phase of the proposed development, which is expected to be at least 40 years from the start of operation. It is currently anticipated that the cable and associated external cable protection will be left in-situ where this is deemed environmentally acceptable; this may require a level of long-term monitoring and maintenance. There are not expected to be any effects on marine physical processes and sediments as a result of this proposed course of action. However, any works required for decommissioning will be subject to future consent applications, and environmental assessments, as relevant.

12.6 Cumulative Effects

Volume 4 Environmental Report for UK Offshore - Chapter 17: Material Assets considers the other users and uses currently within the vicinity of the Celtic Interconnector’s route. A list of projects considered within the cumulative impact assessment is also presented in xxx. From a marine physical processes perspective, no cumulative effects are anticipated.

Commented [A25]: Reference to be added.

12.7 Mitigation and Monitoring Measures

Commented [A26]: Placeholder: All mitigation measures remain under review / discussion, and will be confirmed prior to the submission of the final Application File.

12.7.1 Construction Phase

During the pre-construction engineering and design phase for the Celtic Interconnector Project, a detailed analysis of the seabed along the cable route will be undertaken. From this, the most appropriate installation techniques will be established, as determined by seabed type, to minimise sediment disturbance.

Throughout the route, the most appropriate installation techniques shall be selected, to ensure external cable protection is only installed where necessary; in these situations, the rock protection this will be designed according to seabed type, again, minimising sediment and seabed disturbance. An external rock protection shall be designed in accordance with CIRIA Rock Manual using EN13383:2002 standard armourstone.

12.7.2 Operational Phase

As outlined above, where the need for external rock protection is identified, this will be designed according to the receiving environment, based on seabed type and the need to reduce seabed disturbance. Throughout the Project's lifespan, periodic monitoring of the route will be undertaken every 3-5 years. Should such monitoring identify significant changes in the bathymetry or seabed features in the vicinity of the cable route, appropriate measures will be taken, including replacement or the addition of further external cable protection, as necessary.

12.7.3 Residual Impacts

No significant residual effects on marine physical processes are assessed to occur.

12.8 References

Folk, R.L. (1954). The distinction between grain size and mineral composition in sedimentary rock nomenclature. Journal of Geology, 62: 344-349.

13 Marine Water Quality

13.1 Introduction

This chapter provides an overview of the marine sediment quality likely to be present along and adjacent to the proposed Celtic Interconnector route and considers the potential significant impacts that the marine cable installation and operation may have on marine sediment quality, as well as the mitigation measures to be implemented to avoid, reduce, and offset any potential impacts.

This chapter deals with potential effects of changes to marine sediment quality arising from the installation of the Celtic Interconnector cable in the UK EEZ, including cable protection as required. However, marine sediment quality has the potential to be influenced by other receptors, such as marine physical processes, and changes to marine sediment quality may subsequently cause effects on receptors covered in other chapters. Due to these interactions, this chapter should therefore be read in conjunction with a number of other chapters in Volume 4 Environmental Report for UK Offshore, including;

- Chapter 12: Marine Physical Processes.
- Chapter 13: Marine Water Quality.
- Chapter 14: Biodiversity.
- Chapter 20: Commercial fisheries.

13.2 Methodology and Limitations

13.2.1 Legislation and Guidance

Key legislation relevant to the assessment of potential effects on marine sediments and sediment quality includes:

- The Convention for the Protection of the Marine Environment of the North-East Atlantic (the “OSPAR convention”) 1992 including; (i) the OSPAR Hazardous Substances Strategy; and (ii) Strategy for a Joint Assessment and Monitoring Programme (JAMP);
- The Marine and Coastal Access Act 2009 (MCAA), which provides a framework for the marine licensing system for works below the level of Mean High Water Springs (MHWS);
- The Marine Works (Environmental Impact Assessment) Regulations 2007 (2007 Regulations), as amended by The Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2017, which transpose the 2014/52/EU EIA Directive (amending the 2011/92EU Directive) into English and Welsh law;
- The Conservation of Species and Habitats Regulations 2017 (the Habitats Regulations), which implements EC Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (the Habitats Directive) in the UK;

- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019; and
- The Marine Strategy Framework Directive (MSFD) (2008/56/EC).

Section 63 of the Habitats Regulations states that an Appropriate Assessment is required for any plan or project, not connected with the management of a European site, which is likely to have a significant effect on the site either alone or in combination with other plans and projects. European sites subject to AA within the UK comprise Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar sites. The nearest European site in the UK EEZ is located approximately 23km from the Celtic Interconnector cable route. A Habitats Regulations Assessment (HRA) has been carried out for the Project and is presented in Volume 11.

There are currently no European statutory standards against which to assess the quality of marine sediments. Instead, contaminant levels can be compared to OSPAR background assessment criteria (BAC), which are defined in relation to background concentrations (i.e. concentrations expected in pristine environments), Cefas Action Levels, which are used as standards for dumping of dredged material at sea in the UK (MMO, 2020), and Canadian Sediment Quality Guidelines (Canadian Council of Ministers of the Environment, 1995), which establish likely biological impacts of a given level of contamination, to give an estimation of potential impact. In addition, contaminant levels in marine sediments can be compared to Effects Range Low (ERL) and Effects Range Median (ERM) values determined by Long *et al*. (1995). The ERL and ERM guidelines represent thresholds between minimal (< ERL = < 25% incidence), possible (ERL ≤ ERM = 25-75% incidence), and probable (> ERM = > 75% incidence) adverse biological effects. Adverse biological effects include, for example, altered benthic communities (depressed species richness or total abundance) and elevated sediment toxicity.

Changes to marine sediments and sediment quality have the potential to affect marine water quality through changes in turbidity and release of contaminants. The following legislation is also therefore relevant to the assessment in this chapter:

- The Water Framework Directive (WFD) 2000 (2000/60/EC)[7];
- The Bathing Water Directive (BWD) 2006 (2006/7/EC);
- The Shellfish Waters Directive (SFWD) 2006 (2006/113/EC); and
- The Priority Substances Directive (2013/39/EU), amending the original Priority Substances Directive (2008/105/EC).

The WFD and MSFD seek to ensure, respectively, Good Ecological Status and Good Environmental Status (GES) within designated water bodies with the MSFD covering waters beyond 1 nautical mile (nm) and the WFD covering freshwater, transitional and coastal waters up to 1nm. The Project is planned to cross the UK Exclusive Economic Zone (EEZ), and will not enter UK 12nm territorial waters. However, there is the potential for effects on

[7] It is noted that the Water Framework Directive is directly applicable only to coastal waters, i.e. those within 1nm of land. However, as there is potential for activities associated with the Celtic Interconnector to affect such waterbodies, the WFD has been included here for completeness.

water quality arising as a result of the Project to be detectable in WFD waterbodies. Broadly, GES for the marine environment means that marine waters are:

- Ecologically diverse;
- Clean, healthy and productive; and
- Used sustainably, so that the needs of current and future generations are safeguarded.

The BWD and the SFWD are only applicable at designated bathing waters and shellfisheries, respectively. The Project does not intersect with any designated bathing waters or shellfisheries in the UK EEZ.

The Priority Substances Directive aims to control pollution caused by certain dangerous substances discharged to the aquatic environment. Two lists of compounds have been established. List I contains substances regarded as being particularly dangerous because of their toxicity, persistence and bioaccumulation and the discharge of which must be eliminated. List II contains substances which are less dangerous, but which nevertheless have a deleterious effect on the aquatic environment and the discharge of which must be reduced.

13.2.2 Desktop Studies

A detailed metocean study was carried out by Open Ocean in 2018 in order to provide a detailed description of the wind, wave, current and water level conditions along the Celtic Interconnector route.

A hydro-sedimentary study was carried out by ACRI-HE in 2018/2019, which assessed the potential for sediment mobility induced by currents and waves along the Celtic Interconnector route, in areas where vibrocore samples were acquired and granulometry analyses were carried out.

Sediment chemistry samples were collected as part of the benthic surveys conducted along the cable route, as outlined in Section 6.2.3. Where appropriate, additional third-party information has been used to supplement these data.

Information on projects with the potential to interact with the Celtic Interconnector on a cumulative level has been based on that presented in Chapter xxx.

Commented [A27]: Reference to be added.

13.2.3 Field Studies

A number of marine and coastal surveys have been completed along the proposed cable route, with findings and wider reporting being provided by:

- Celtic Interconnector Study Synthesis. Prepared by Wood Group for EirGrid & RTE. Doc Ref: 400584-PL-REP-001, Rev: H. July 2019;
- Celtic Interconnector Project. Volume 1 - Combined Inshore, Nearshore and Offshore Environmental Field Reports. Project No: 2015-001. Client Ref No: CELTIC-SUR1415-BEN-R01-V01 (BHM_2015-001). December 2015. Report prepared for EirGrid Plc and RTE by Bibby HydroMap and Benthic Solutions;

- Celtic Interconnector Project. Volume 2 - Combined Celtic Interconnector Habitat Assessment Survey and Environmental Baseline Report. Project No: 2015-001. Client Ref No: CELTIC-SUR1415-BEN-R02-V02 (BHM_2015-001). January 2016. Report prepared for EirGrid Plc and RTE by Bibby HydroMap and Benthic Solutions; and
- Celtic Interconnector Project. Benthic Survey Report. Final report. Ref No: 2018-0019-016-BNT, Revision C3. September 2018. Report prepared for EirGrid Plc and RTE by Next Geosolutions.

Detailed geophysical, geotechnical and benthic surveys were undertaken in along the Interconnector cable route. These surveys included physico-chemical sampling of surficial sediments for particle size analysis (PSA), total organic carbon (TOC), total organic matter (TOM), heavy and trace metals, and hydrocarbons.

13.2.4 Methodology for Assessment of Effects

Within this chapter a systematic approach to the assessment of effects has been followed where possible, which includes:

- A description of the relevant baseline conditions;
- A description of any proposed mitigation measures incorporated into the proposal;
- Identification and assessment of potential effects;
- Identification and assessment of cumulative effects (where appropriate); and
- Identification and assessment of residual effects remaining following the implementation of mitigation.

The assessment of effects on marine water quality broadly follows the methodology presented in Volume 4 Environmental Report for UK Offshore - Chapter 7: Assessment Methodology. The evaluation and assessment within this chapter has been undertaken with reference to relevant parts of the 2010 guidelines for Ecological Impact Assessment in Britain and Ireland (Marine and Coastal), and 2018 Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland developed by the Chartered Institute of Ecology and Environmental Management (CIEEM). This is recognised as current best practice for ecological assessment and provides guidance to practitioners for refining their own methodologies.

The assessment considers, as appropriate: direct, indirect, secondary and cumulative impacts and whether the impacts and their effects are short, medium, long-term, permanent, temporary, reversible, or irreversible. The assessment of impacts then takes into account the baseline conditions to describe:

- How the baseline conditions will change as a result of the project and associated activities; and
- Cumulative and in-combination impacts of the proposal and those arising from other developments.

The significance of a potential impact is defined by the sensitivity of the receiving environment and the character of the predicted impact (as outlined in Volume 4

Environmental Report for UK Offshore - Chapter 7: Assessment Methodology). In some cases, magnitude or significance cannot be quantified with certainty; in these cases, professional judgement is used to identify the significance of an impact.

Despite it only being necessary to assess and report significant residual effects (those that remain after mitigation measures have been taken into account), it is good practice to make clear both the potential significant effects without mitigation and the residual significant effects following mitigation. This helps to identify necessary and relevant mitigation measures that are proportionate to the size, nature and scale of anticipated effects. Impacts are therefore considered initially in the absence of mitigation. After avoidance / mitigation measures and necessary compensation measures have been applied, and opportunities for enhancement incorporated, impacts are reassessed and residual impacts are identified.

In the Scoping Report for Marine Licence Application and Environmental Report [reference] produced for the Celtic Interconnector Project, three potential effects on marine sediment quality were identified. These were:

Commented [A28]: Reference to be added

- Disturbance of seabed during cable installation and rock armour formation;
- Changes in sediment transport regime; and
- Changes in water quality through release of contaminants held in marine and coastal sediments.

While the baseline condition of marine sediments and sediment quality is covered in this chapter, assessment of the effects associated with changes in water quality through release of contaminants held in marine and coastal sediments is covered in Volume 4 Environmental Report for UK Offshore - Chapter 11: Marine Sediment Quality.

13.3 Receiving Environment

Data collected as part of surveys of the proposed cable route indicate that the seabed along the Celtic Interconnector cable route is heterogeneous in nature, varying from low energy silty sands to high energy mega-rippled sands, gravel and occasional cobbles and small boulders. In the UK EEZ, surficial sediments were found to be generally characterised by very fine to very coarse sands with occasional gravels and pebbles. The dominant sediment type present in this section of the cable route was gravelly muddy sand (as per Folk, 1954), with maximum levels of ~98% sand recorded in samples collected from the UK EEZ.

In the UK EEZ, high (>30%) proportions of gravel were only recorded at a single station (128). Percentages of fines (i.e. <63µm diameter sediments) were also generally low (<5%), with the exception of two sampling stations where fines were recorded at 38-40%. The generally low percentage of fines recorded is consistent with relatively high energy environments, where near-seabed stress is high and rates of sedimentation are low. Silts and clays often remain suspended due to high tidal currents.

Total organic matter (TOM) is made up from a mixture of different organic materials, but is predominantly naphthenic materials (such as carboxylic acids and humic substances), which play an important role within the benthic community as a potential food source to deposit-feeding organisms. Organic matter is an important scavenger of other chemical components, such as heavy metals and some hydrocarbon compounds (McDougall, 2000). Total organic carbon (TOC) represents the proportion of biological material and organic detritus within the substrate. Changes in TOC may reflect changes in both physical factors (e.g. addition of fines) and common co-varying environmental factors through greater sorption on increased sediment surface areas (Thompson and Lowe, 2004).

The levels of TOM in samples collected in 2015 were low and consistent along the UK EEZ section of the Celtic Interconnector cable route (<3%). Percentage TOC was also low, ranging from below detection limit (<0.1%) to up to 0.45%. These low values are representative of an organically deprived environment.

The total hydrocarbon content (THC) of the sediments sampled in 2015 were low throughout the UK EEZ section of the Celtic Interconnector cable route, with values ranging from below detection limit (<10mg/kg) to 23mg/kg. These results indicate that there is no significant hydrocarbon contamination along the UK section of the interconnector cable route.

Metals occur naturally in the marine environment and are widely distributed in both dissolved and sedimentary forms. Some are essential to marine life while others may be toxic to certain organisms (Paez-Osuna and Ruiz-Fernandez, 1995). Some, such as zinc, may be essential for normal metabolism but can become toxic above a critical threshold (Long *et al*., 1995). The bioavailability (and therefore toxicity) of individual metals to marine organisms is dependent on a number of factors, including sediment grain size, TOC content, and acid-volatile sulphide concentrations (Long *et al*., 1995).

Trace metals are present in sediments within the sediment particles themselves (as components of minerals), adsorbed to the surfaces of sediment particles, and on the surfaces of organic matter (by forming metal-organic ligand complexes). Trace metals that are intrinsic parts of sediment particles (residual) are not bioavailable. Trace metals that are associated with the surfaces of particles within the sediment (non-residual) may be bioavailable and can include trace metals originating from sources of pollution. The analytical method used to determine metal concentrations in marine sediments does not differentiate between non-residual and residual trace metal concentrations (as samples undergo mineral digestion by hydrofluoric acid before quantification of metal concentrations). Therefore, if a metal is found in high concentrations it does not necessarily follow that this will have a detrimental effect on the environment. It is necessary to use other pieces of information (e.g. particle size and TOC results) to determine whether the concentrations found have the potential to be toxic to benthic marine life (Long *et al*., 1995).

Analysis of samples collected as part of the 2015 survey of the interconnector cable route indicates that concentrations of heavy and trace metals are generally low and consistent throughout the survey corridor in the UK EEZ.

Sediment concentrations of cadmium, chromium, copper, lead, mercury, nickel and zinc were low throughout the UK EEZ section of the interconnector cable route. All stations recorded these metals at concentrations below Cefas Action Level 1 values, Canadian Sediment Quality Guidelines threshold effect levels (TEL), and OSPAR BAC values. Tin concentrations were also low at all stations sampled, with most results below detection limits.

Sediment concentrations of arsenic were more variable, with levels in the UK EEZ ranging from 2.3 – 15.1mg/kg. Four of the ten samples collected in the UK EEZ contained arsenic concentrations exceeding the Canadian Sediment Quality Guidelines TEL; three of these also exceeded the ERL (Long *et al*., 1995). However, all values fell below the OSPAR BAC level for arsenic. Arsenic is often associated to iron containing minerals, to which they adsorb. The higher levels of arsenic detected do not, therefore, necessarily indicate contamination.

Concentrations of iron and aluminium in the UK EEZ showed high variability between samples; this likely reflects physical differences between the samples, with higher iron and aluminium levels associated with higher proportions of fines.

Barium concentrations were consistently low throughout the interconnector cable route, with an average concentration of 12.0mg/kg. Barium is typically insoluble in the form of a non-toxic sulphate (Gerrard *et al*., 1999) and as such is generally not bioavailable to marine fauna. Barium sulphates are often associated with other heavy metals, such as cadmium, chromium, copper, lead, mercury and zinc, however no obvious geographical patterns or correlations with other metals were detected, although the highest concentrations of barium were found in samples containing relatively high concentrations of TOC.

Vanadium is often associated with the oil and gas industry as it is present in relatively high concentrations in most crude oils (Khalaf *et al*., 1982). Most vanadium enters seawater in suspension or colloidal form, passing quickly out of the water column and depositing in sediments (Cole *et al*., 1999), and as such could be considered as being relatively non-bioavailable. Vanadium concentrations were found to be low throughout the interconnector cable route.

In summary, the concentrations of heavy and trace metals in surficial sediments along the interconnector cable route in the UK EEZ were found to be generally low and consistent throughout, with all concentrations below OSPAR BAC thresholds, suggesting that little anthropogenic contamination had occurred in the survey area.

The baseline environment is not static and will exhibit some degree of natural change over time, with or without the Project in place, due to naturally occurring cycles and processes. Therefore, when undertaking impact assessments, it is necessary to place any potential impacts in the context of the envelope of change that might occur naturally over the timescale of the Project.

Further to potential change associated with existing cycles and processes, it is necessary to take account of the potential effects of climate change on the marine environment. Mean sea level is likely to rise during the 21st Century as a consequence of either vertical land (isostatic) movements or changes in eustatic sea level. A rise in sea level may allow larger waves, and therefore more wave energy, to reach the coast in certain conditions and consequently result in an increase in local rates or patterns of erosion and the equilibrium position of coastal features. It is however unlikely that significant changes in the level of contaminants in the benthic sediments of the UK continental shelf will occur as a result. In addition, there is a high degree of uncertainty of how winter storm tracks over the North Atlantic Ocean may be altered due to climate change. Natural variability in wind speeds and hence wave heights is large and dominant and is projected to remain so for the century to come (Gallagher *et al*., 2016).

13.4 Characteristics of the Development

Volume 4 Environmental Report for UK Offshore - Chapter 5: Project Description provides a detailed account of the Project including works to be conducted in the marine environment.

The installation of the Celtic Interconnector will cause disturbance to the seabed, with resulting effects on marine sediments and sediment quality in the immediate vicinity. The mechanisms by which this will occur are described in the following sections.

13.4.1 Cable Route

The cable route within the UK EEZ passes approximately 30km to the west of the Isles of Scilly and approximately 75km to the west of Land's End on the UK mainland, covering a distance of approximately 211km in water depths of 80-100m.

The installation of the submarine cable as part of the marine construction works will typically follow a sequence similar to the following:

- Contractor survey, route engineering and finalisation;
- UXO intervention campaign (if required);
- Boulder clearance;
- Sandwave pre-sweeping;
- Pre-lay grapnel runs;
- Construction of infrastructure crossings;
- Pre-lay route survey;
- Cable lay and post-lay survey; and
- Burial and post-burial survey.

Installation of the cable will be undertaken using methods including (as appropriate to local seabed conditions) ploughing, jetting and mechanical trenching. Optimum burial depths of 0.8m to 2.5m are sought for the cable; where this is not possible, appropriate external cable protection shall be installed.

During preparatory works, activities likely to cause disturbance of the seabed include boulder removal and sandwave sweeping. During construction works, pre-lay grapnel runs, construction of infrastructure crossings, cable lay and cable burial all are likely to cause seabed disturbance. Sediments and seabed features (such as sandwaves) have the potential to be permanently lost via these activities, and there may be localised changes in the sediment transport regime as a result.

Based on an assumption that a corridor of approximately 15m width will be disturbed by cable-laying equipment along a length of 211km (in the UK EEZ), an area of approximately 3.2km^2 will be directly disturbed by cable installation. Depending on the installation method used, the trench created by installation may be partly back-filled by the cable-laying equipment.

Commented [A29]: **Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.**

There is the potential for marine water quality to be impacted by any activity which causes disturbance of the seabed along the route through release of contaminants held in surficial sediments. However, changes in marine water quality arising from seabed disturbance is only a risk in heavily contaminated locations. Sediment samples collected as part of cable route surveys in 2015 indicate the seabed along the cable route in the UK EEZ is not contaminated. Surveys of the cable route (i.e. pre-lay, post-lay and post-burial) will not cause significant resuspension of seabed sediments.

13.4.2 Cable Protection

For those areas where the optimum burial depth cannot be achieved, external cable protection will be installed. The primary external protection approach is through rock placement (Volume 4 Environmental Report for UK Offshore - Chapter 5: Project Description). However, a number of other options could be considered, notably concrete mattressing. Rock placement would be sourced from certified quarries, with well-developed infrastructure.

The requirement for external cable protection will be established during the detailed design phase. The exact length of the route which will need this additional protection is therefore not known at the time of writing. For the purposes of assessing potential effects, a precautionary approach has been employed and it has been assumed that the whole length of the cable route within the UK EEZ (i.e. 211km) will be protected. As a ‘worst case scenario’ it has been assumed that cable protection will be installed in a 15m wide corridor centred on the actual cable, resulting in an area of approximately 3.2km^2 covered by external protection. However, external protection will only be required in areas where trenching is not deemed feasible, through either the presence of other seabed assets or obstacles (such as at cable crossings), where ground conditions are too hard, or where secondary protection is required to achieve the required burial depth.

On areas of hard substrate, the deployment of external rock protection will result in addition of hard material into areas where such conditions already exist, therefore there will be not be a significant change to the seabed types present and should not significantly affect the local sediment regime. Where external rock protection is installed over cable crossings, or as secondary protection, there is the potential for permanent loss of seabed features in sedimentary environments. However, this is anticipated to be over a small area compared to the wider route.

Introduction of hard material into an area which is predominantly sedimentary has the potential to result in localised changes to hydrographic conditions, and associated sediment dynamics. It is anticipated that some level of scour may occur where external cable protection is installed. However, due to the intrinsic purpose of the cable protection, the protection will be designed to minimise scour.

Scour of seabed sediments around the cable protection has the potential to cause changes in marine water quality through release of contaminants held in benthic sediments. However, changes in marine water quality arising from seabed disturbance is only a risk in heavily contaminated locations.

13.5 Likely Significant Impacts of the Development

13.5.1 Do Nothing

In the 'Do Nothing' alternative, there would be no marine construction works associated with the Celtic Interconnector, and therefore the existing baseline environment would be expected to remain unchanged, subject to natural variation. The evolution of the marine environment in the absence of the Project will depend on future levels of marine activity such as military operations and offshore developments, future resource exploitation such as fishing, and the effectiveness of protected site management, as well as variation due to climate change. Some of these possible changes may be planned, such as marine renewable energy developments and cables. Others, however, will be subject to change such as the evolution of commercial fishing activities as influenced by economic and resource availability factors, the evolution of maritime traffic as influenced by economic and port related factors, and the evolution of maritime fleets as influenced by on-board waste management practices.

13.5.2 Installation Phase

During the installation phase of the Celtic Interconnector, surficial sediments will be disturbed along the marine cable route. Seabed sediments will be resuspended into the water column and will then settle out again, which can have an effect, either positive or negative, on benthic habitats and species (Dernie *et al*., 2003) (Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity).

Compared to other offshore activities such as bottom trawling, ship anchoring or large-scale dredging, seabed disturbance resulting from subsea cable activities is considered temporary and has a relatively limited extent (Carter *et al*., 2009; OSPAR, 2012), with the seabed usually returning to its original state (BERR, 2008). The disturbance itself is restricted to a narrow strip of seabed, normally limited to an area 2-3m either side of the cable (Bald *et al*., 2014; Carter *et al*., 2009), or in the order of 10m width if the cable has been ploughed into the seabed (OSPAR, 2009).

Installation tools may have a footprint up to 10m width depending on the burial method used (OSPAR, 2009; NIRAS, 2015). The level of seabed disturbance caused during clearance or installation also largely depends on the equipment being used, as well as on the sediment type (BERR, 2008). The level of disturbance caused by ploughs is considered to be lower compared to jetting techniques (OSPAR, 2012; NIRAS, 2015).

Dispersion of disturbed sediments is dictated by the local hydrodynamic regime, particularly near-bottom current speeds (BERR, 2008). Coarser sediments such as sand and gravel settle relatively close to the origin of disturbance, while finer sediments such as clay and silt can remain in suspension for a longer period of time creating a larger impact footprint. However, a greater dispersion also results in a smaller level of deposition at any given point. The majority of sediment deposition occurs within tens of meters of the cable route (OSPAR, 2009).

The cable burial technique used in the UK EEZ may vary depending on the geology of the seabed. However, assuming that a corridor of approximately 15m width will be disturbed by cable-laying equipment, along a length of 211km (in the UK EEZ waters), an area of approximately 3.2km^2 will be directly disturbed by cable installation. Depending on the installation method used, the trench created by installation may be partly back-filled by the cable-laying equipment.

Where external cable protection is not installed, trenches will be naturally infilled along the majority of the cable route through a combination of natural collapse of temporary trench walls, the resettling of disturbed suspended sedimentary material, and bioturbation. In these areas, effects on the seabed are considered to be temporary and, following natural infilling, the seabed will return to near pre-installation conditions.

The cable route does not pass through any habitats or areas of environmental sensitivity, therefore receptor value for sediment quality is considered to be low to negligible. As described above, the area of seabed with potential to be affected by temporary disturbance is small within the wider setting of UK EEZ, resulting in a low magnitude of change. Effects as a result of disturbance to seabed sediments during the installation phase are therefore considered to be not significant.

The introduction of hard material in the form of external cable protection into the predominantly sedimentary environment of the interconnector cable route has the potential to cause localised changes to hydrographic conditions and associated sediment dynamics. The sediments along the cable route are primarily composed of mobile sands. It is therefore anticipated that some level of scour may occur where external cable protection is installed. However, due to the intrinsic purpose of the cable protection, the protection will be designed to minimise scour. Should scour occur, however, the sediment type present along the cable route (i.e. sands and gravels) means that sediment suspension will be temporary, with sediments expected to settle out within a single spring-neap tidal cycle. As receptor value is low to negligible, and low levels of scour are expected, effects on local sediment dynamics through the presence of external cable protection are considered to be not significant.

In addition to causing disturbance of seabed sediments, the installation phase has the potential to release/remobilise contaminants held within the sediment when the seabed is disturbed (BERR, 2008). The location and type of sediment will determine whether contaminants are likely to be held in the benthic environment.

Contaminants such as oil and heavy and trace metals are most likely found near the coastline, generally attached to fine sediments, although certain chemicals can persist in coarser sediments (BERR, 2008). Contaminant release is only a concern in heavily contaminated locations, such as major ports, oil and gas developments, historical industrial areas, and waste disposal or natural sinks, and is of less importance when considering offshore areas (OSPAR, 2009), such as the area of the UK EEZ in which the Celtic Interconnector cable will be installed.

The majority of organic compounds present in the environment are either readily biodegradable or of low water solubility and hence of limited significance in terms of water contamination (Tran *et al*., 1996). However, some organic compounds can reach toxic concentrations in the dissolved phase, and/or bioaccumulate from the dissolved phase to toxic levels. These include organo-metallic compounds of lead, tin and mercury.

The release of contaminants usually occurs within a localized area for a short period of time during the installation (and potentially during any maintenance activities or decommissioning), and should only be of concern near industrialised areas (BERR, 2008). Sediment samples collected as part of the cable route surveys in 2015 indicate that the seabed along the cable route in the UK EEZ is not contaminated. Furthermore, bioavailable metals and hydrocarbons are generally associated with fine sediments (i.e. <63µm) and higher TOC content. As the surficial sediments along the interconnector cable route are predominantly sands with low associated TOC values, the risk of resuspension and subsequent desorption of contaminants is lower than in very muddy sediments.

Contamination arising from seabed disturbance is only a risk in heavily contaminated locations (OSPAR, 2009). Sediment samples collected as part of cable route surveys indicate that the seabed along the cable route in the UK EEZ is not contaminated. Sediments which are suspended due to cable burial are not expected to settle out more than 10km away from the installation area, with the majority (>90%) being deposited within 1km (BERR, 2008; Aquind, 2019). The sediment is expected to settle out within a single spring-neap tidal cycle. As receptor value is low to negligible, and magnitude of change is expected to be low, changes in water quality through release of contaminants held in marine and coastal sediments are considered to be not significant.

The potential for indirect effects on ecological features arising from changes to sediment quality along the cable route is presented in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity

13.5.3 Operational Phase

Once the cable and its associated infrastructure are installed and operating, it is anticipated that they will require minimal maintenance. However, in the event of the cable getting damaged or becoming faulty, operational maintenance activities would be required to repair the affected components. For offshore components, the cable may need to be cut at the appropriate location and brought to the surface for repair before being put back into place on the seabed or replaced. Operational maintenance activities would typically comprise similar vessels, activities and locations as the installation works.

Sediments are likely to be disturbed during cable maintenance activities, and effects are considered to be the same as for the installation phase.

The cable route does not pass through any habitats or areas of environmental sensitivity, therefore receptor value for sediment quality is considered to be low to negligible. As described above, the area of seabed with potential to be affected by temporary disturbance is small within the wider setting of UK EEZ, resulting in a low magnitude of change. Effects as a result of disturbance to seabed sediments during the installation phase are therefore considered to be not significant.

The introduction of hard material in the form of external cable protection into the predominantly sedimentary environment of the interconnector cable route has the potential to cause localised changes to hydrographic conditions and associated sediment dynamics. The sediments along the cable route are primarily composed of mobile sands. It is therefore anticipated that some level of scour may occur where external cable protection is installed. However, due to the intrinsic purpose of the cable protection, the protection will be designed to minimise scour. Should scour occur, however, the sediment type present along the cable route (i.e. sands and gravels) means that sediment suspension will be temporary, with sediments expected to settle out within a single spring-neap tidal cycle. As receptor value is low to negligible, and low levels of scour are expected, effects on local sediment dynamics through the presence of external cable protection are considered to be not significant.

Contamination arising from seabed disturbance is only a risk in heavily contaminated locations (OSPAR, 2009). Sediment samples collected as part of cable route surveys indicate that the seabed along the cable route in the UK EEZ is not contaminated. Sediments which are suspended due to cable burial are not expected to settle out more than 10km away from the installation area, with the majority (>90%) being deposited within 1km (BERR, 2008; Aquind, 2019). The sediment is expected to settle out within a single spring-neap tidal cycle. As receptor value is low to negligible, and magnitude of change is expected to be low, changes in water quality through release of contaminants held in marine and coastal sediments are considered to be not significant.

The potential for indirect effects on ecological features arising from changes to marine sediments and sediment quality along the cable route is presented in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity.

13.5.4 Decommissioning Phase

A decommissioning plan will be prepared prior to the decommissioning phase of the proposed development, which is expected to be at least 40 years from the start of operation. It is currently anticipated that the cable and associated external cable protection will be left in-situ where this is deemed environmentally acceptable; this may require a level of long-term monitoring and maintenance. There are not expected to be any effects on marine water quality and sediments as a result of this proposed course of action. However, any works required for decommissioning will be subject to future consent applications, and environmental assessments, as relevant.

13.5.5 Cumulative Effects

There are currently no other developments with the potential likely to cause cumulative impacts with the Project in the UK EEZ.

13.6 Mitigation and Monitoring

Commented [A30]: Placeholder: All mitigation measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

13.6.1 Installation Phase

In line with guidelines outlined in BERR (2008) and OSPAR (2012), the cable route has been designed to avoid European designated sites including SACs and SPAs and thus minimise any potential effects to areas of conservation importance.

During the pre-construction engineering and design phase for the Celtic Interconnector, a detailed analysis of the seabed along the route of the Celtic Interconnector will be undertaken. From this, the most appropriate installation techniques will be established, as determined by seabed type, to minimize sediment disturbance and hence minimise effects on marine sediments and sediment quality. In addition, where external cable protection is required, this will be designed according to seabed type, again, minimizing sediment and seabed disturbance. Minimising seabed disturbance will minimise the potential resuspension of contaminants from seabed sediments to the water column.

Where the need for external rock protection is identified, this will be designed according to the receiving environment, based on seabed type, and the need to reduce seabed disturbance. Cable protection will be designed to minimise scour, and hence resuspension of sediments. Rock placement would be sourced from certified quarries, with inert natural stone material used to minimise the degree of impact.

13.6.2 Operational Phase

Throughout the Project’s lifespan, periodic monitoring of the cable route will be undertaken; should such monitoring identify significant changes in the bathymetry or seabed features (i.e. sediment type) in the vicinity of the cable route, appropriate measures will be taken, including replacement or addition of further external cable protection, as necessary.

13.6.3 Residual Impacts

No significant residual effects on marine physical processes are anticipated.

13.7 References

Aquind Limited (2019). Aquind Interconnector Environmental Statement, November 2019.

Bald, J., Hernández, C., Galparsoro, I., Germaán Rodrigues, J., Muxika, I., Enciso, Y.T. and Marina, D. (2014). Environmental impacts over the seabed and benthic communities of submarine cable installation in the Biscay marine energy platform. Proceedings of the 2nd international conference on environmental interactions of marine renewable energy technologies (EIMR2014622), 28 April – 02 May 2014, Stornoway, Isle of Lewis, Outer Hebrides, Scotland.

BERR (2008). Department for Business Enterprise & Regulatory Reform. Review of cabling techniques and environmental effects applicable to the offshore wind farm industry. Technical Report. January 2008.

Canadian Council of Ministers of the Environment (1995). Protocol for the derivation of Canadian sediment quality guidelines for the protection of aquatic life. CCME EPC-98E. Prepared by Environment Canada, Guidelines Division, Technical Secretariat of the CCME Task Group on Water Quality Guidelines, Ottawa.

Carter, L., Burnett, D., Drew, S., Marle, G., Hagadorn, L., Bartlett-McNeil, D. and Irvine, N. (2009). Submarine cables and the oceans: connecting the world. UNEP-WCMC Biodiversity Series No. 31. ICPC/UNEP/UNEP-WCMC, 64pp.

Cole, S., Codling, I. D., Parr, W. and Zabel, T. (1999). Guidelines for managing water quality impacts with European marine sites. Report prepared for the UK Marine SACs project. October 1999, Swindon WRc

Dernie, K.M., Kaiser, M.J. and Warwick, R.M. (2003). Recovery rates of benthic communities following physical disturbance. *Journal of Animal Ecology*, 72(6): 1043-1056.

Folk, R.L. (1954). The distinction between grain size and mineral composition in sedimentary rock nomenclature. *Journal of Geology*, 62: 344-349.

Gallagher, S., Gleeson, E., Tiron, R., McGrath, R., and Dias, F. (2016). Twenty-first century wave climate projections for Ireland and surface winds in the North Atlantic Ocean, *Adv. Sci. Res*., 13: 75-80

Gerrard, S., Grant, A., March, R. and London, C. (1999). Drill Cuttings Piles in the North Sea. Management options during Platform Decommissioning. Centre for Environmental Risk Report No 31. University of East Anglia.

Khalaf, F., Literathy, V., and Anderlini, V. (1982). Vanadium as a tracer of oil pollution in the sediments of Kuwait. *Hydrobiologia*, 91-92:147-154.

Long, E.R., MacDonald, D.D., Smith, S.L. and Calder, F.D. (1995). Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. *Environmental Management*, 19(1):81-97

Marine Management Organisation (MMO) (2020). Guidance Marine Licensing: sediment analysis and sample plans. Details of sediment and sample analysis for marine licence applications. Published 2 October 2014. Last updated 14 September 2020. Available at: https://www.gov.uk/guidance/marine-licensing-sediment-analysis-and-sample-plans###Suitability%20of%20material [Accessed 18/12/20].

McDougall, J. (2000). The significance of hydrocarbons in the surficial sediments from Atlantic Margin regions.

NIRAS Consulting Ltd (2015). Renewables Grid Initiative Subsea Cable Interactions with the Marine Environment: Expert review and Recommendations Report.

OSPAR (2009). Assessment of the environmental impacts of cables. OSPAR Commission. 19 pp.

OSPAR Convention (2012). Guidelines on Best Environmental Practice (BEP) in Cable Laying and Operation (Agreement 2012-2). (Source: OSPAR 12/22/1, Annex 14).

Paez-Osuna, F., and Ruiz-Fernandez, C. (1995). Comparative Bioaccumulation of Trace Met-als in *Penaeus stylirostris* in Estuarine and Coastal Environments. *Estuarine, Coastal and Shelf Science* 40: 35-44.

Thompson, B., and Lowe, S. (2004). Assessment of macrobenthos response to sediment con-tamination in the San Francisco estuary, California, USA. *Environmental Toxicology and Chemistry*, 23: 2178–2187.

Tran, K., Yu, C.C. and Zeng, E.Y. (1996). Organic pollutants in the coastal environment off San Diego, California. 2. Petrogenic and biogenic sources of aliphatic hydrocarbons. *Environmental Toxicology and Chemistry*, 16(2): 189-195.

Wood (2021). Celtic Interconnector – Technical Note: Proposed scope and content of the UK Marine Licence Application and supporting Environmental Report and Assessments.

14 Biodiversity

Commented [A31]: CHAPTER PLACEHOLDER: Chapter remains under production and further input from technical specialists remains ongoing to address the outstanding comments in the document. Where applicable, this shall include alignment with the Biodiversity chapter in Volume 3D Part 1.

14.1 Introduction

This chapter of the ER assesses the likely significant effects[8] of the Project with respect to biodiversity, including benthic habitats and ecology, natural fish ecology, ornithology, marine mammals and reptiles. The chapter should be read in conjunction with the project description provided in Volume 4 Environmental Report for UK Offshore – Chapter 5**:** Project Description and with respect to relevant parts of other chapters, notably Volume 4 Environmental Report for UK Offshore – Chapter 18: Noise and Vibration, where common receptors have been considered and where there is an overlap or relationship between the assessments of effects. In this chapter, receptors are referred to as ecological features, to accord with the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine'. The term ecological feature is defined in the guidance as pertaining to habitats, species, and ecosystems.

Information to inform appropriate assessment, as required by European Communities (Birds and Natural Habitats) Regulations 2011 is provided in Volume 4A Screening Report and Natura Impact Statement.

14.2 Methodology and Limitations

14.2.1 Legislation and Guidance

The UK legislation relevant to this assessment, protecting key elements of the biodiversity, is:

- Conservation of Offshore Marine Habitats and Species Regulations 2017 (the Offshore Regulations);
- Conservation of Habitats and Species Regulations 2017;
- Conservation (Natural Habitats, &c.) Regulations 1994 (Statutory Instrument No. 2716);
- Wildlife and Countryside Act 1981 (as amended);
- Countryside Rights of Way Act 2000;
- Wildlife (Northern Ireland) Order 1985;
- Nature Conservation (Scotland) Act 2004;
- The Conservation of Seals Act 1970;

[8] In the Biodiversity chapter, the term "potentially significant effects" is used in the sections prior to the "scope of the assessment" (Section 6.7) being determined, as it accords with CIEEM guidance. The term "likely significant effects" is used once the scope of the assessment has been determined. The use of this term is not to be confused with Likely Significant Effects (LSEs) as used in the context of the Habitats Regulations Assessment (HRA) process.

- Conservation of Seals (England) Order 1999; and
- Seal Products Regulations 2010.

The primary planning policy relevant to this assessment is the Draft South West Inshore and South West Offshore Marine Plan, as established under the UK Marine Policy Statement (last updated 2020).

The impact assessment guidance relevant to this assessment is:

- Chartered Institute of Ecology and Environmental Management (CIEEM 2018) 'Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine'.
- Guidance for the marine area in England and Wales and the UK offshore marine area (JNCC, 2010),

For marine faunal groups a qualitative assessment has been undertaken on the basis of the noise criteria presented in Volume 4 Environmental Report for UK Offshore – Chapter 18: Noise and Vibration and the sensitivity of the species concerned.

14.2.2 Legislation specific to Marine Mammals and Turtles

Under both the Offshore Habitats Regulations 2017 and the Habitats Regulations 2017, all species of cetacea and five marine turtle species, are classified as European Protected Species (EPS) (as listed in Annex IV of the EU Habitats Directive 92/43/EEC.

Additional treaties, agreements and legislative instruments for the conservation and protection of marine wildlife, including cetaceans, seals, and marine turtles, that have been recorded within the vicinity of the Project, are summarised in Table 14.1.

Table 14.1 Additional Treaties, Agreements and Legislative Instruments (marine mammals and turtles in the Project area)

Minke whale *(Balaenoptera acutorostrata)*	• The Convention on the Conservation of European Wildlife and Natural Habitats ("Bern Convention") – Appendix III (regulated exploitation). • IUCN Red List of Threatened Animals (1996) – species occurring in the UK. • Long list of Globally Threatened/Declining Species (1995). • Natural Environment and Rural Communities Act (NERC) Act 2006. Section 41 and 42: Species of Principal Importance in England and Wales. • UK List of Priority Species List (UK Biodiversity Action Plan (BAP) species_2007). • British Species of Conservation Concern List (species under threat).
Sei whale *(Balaenoptera borealis)*	• Bern Convention – Appendix III (regulated exploitation). • IUCN Red List of Threatened Animals (1996) – species occurring in the UK. • Long list of Globally Threatened/Declining Species (1995). • NERC Act 2006. Section 41: Species of Principal Importance in England. • UK List of Priority Species List (UK BAP species 2007). • British Species of Conservation Concern List (species under threat). • Convention on the International Trade in Endangered Species of Wild Flora and Fauna (CITES) - Appendix I (all stocks).
Common bottlenose dolphin (*Tursiops truncatus*)	• Bern Convention – Appendix II (strict protection) and Appendix III (regulated exploitation). • The 1975 Convention on the Conservation of Migratory Species (CMS) ("Bonn Convention") – Appendix II (unfavourable conservation status). • EU Habitats Directive – Annex II. • IUCN Red List of Threatened Animals (1996) – species occurring in the UK. • Long list of Globally Threatened/Declining Species (1995).

	• NERC Act 2006. Section 41 and 42: Species of Principal Importance in England and Wales. • UK List of Priority Species List (UK BAP species 2007). • British Species of Conservation Concern List (species under threat).
Short-beaked common bottlenose dolphin (*Delphinus delphis*)	• Bern Convention – Appendix II (strict protection) and Appendix III (exploitation regulated verses population status). • Bonn Convention – Appendix II (unfavourable conservation status). • Long list of Globally Threatened/Declining Species (1995). • NERC Act 2006. Section 41 and 42: Species of Principal Importance in England and Wales. • UK List of Priority Species List (UK BAP species_2007). • British Species of Conservation Concern List (species under threat).
Harbour porpoise (*Phocoena phocoena*)	• Bern Convention – Appendix II (strict protection) and Appendix III (exploitation regulated verses population status) • Bonn Convention – Appendix II (unfavourable conservation status). • EU Habitats Directive – Annex II. • IUCN Red List of Threatened Animals (1996) – species occurring in the UK. • Long list of Globally Threatened/Declining Species (1995). • NERC Act 2006. Section 41 and 42: Species of Principal Importance in England and Wales. • UK List of Priority Species List (UK BAP species 2007). • British Species of Conservation Concern List (species under threat). • The Convention for the Protection of the Marine Environment of the Northeast Atlantic (OSPAR) – Annex V (protecting ecosystem and biological diversity of the maritime area). Listed as a threatened or declining species.
Grey seal (*Halichoerus grypus*)	• Conservation of Seals Act 1970

Harbour seal (*Phoca vitulina*)	• Bern Convention – Appendix III (exploitation regulated verses population status). • Bonn Convention – Appendix II (unfavourable conservation status). • EU Habitats Directive – Annex II. • British Species of Conservation Concern List (species under threat).
Leatherback Turtle (*Dermochelys coriacea*); and **Loggerhead Turtle** (*Caretta caretta*)	• OSPAR – Annex V (protecting ecosystem and biological diversity of the maritime area). Listed as a threatened or declining species. • UK List of Priority Species List (UK BAP species 2007). • NERC Act 2006. Section 41 and 42: Species of Principal Importance in England and Wales. • Bern Convention – Appendix II (strict protection). • Bonn Convention – Appendix II. • EU Habitats Directive – Annex II (loggerhead only) and Annex IV (leatherback and loggerhead). • Schedule 2 of The Conservation of Habitats and Species Regulations 2010. • CITES – Appendix I (loggerhead only).
Kemp's Ridley (*Lepidochelys kempii*)	• Bern Convention – Appendix II (strict protection). • Bonn Convention – Appendix I. • EU Habitats Directive – Annex IV. • Schedule 2 of The Conservation of Habitats and Species Regulations 2010. • CITES – Appendix I.

* Distribution of marine mammals and turtles within the Project area was determined with reference to Hammond et al (2017), Reid et al (2003), Botterell et al (2010) and the NBN Atlas.

14.2.3 Basking Shark

Additional treaties, agreements and legislative instruments for the conservation and protection of basking shark, have been recorded in the Project area. These are:

- Bern Convention – Appendix II (strict protection).
- IUCN Red List of Threatened Animals (1996) – species occurring in the UK.
- Common Fisheries Policy (CFP) – prohibited species in the EU.

- UK List of Priority Species List (UK BAP species_2007).
- CITES – Appendix II.
- Bonn Convention – Appendix I and II.
- United Nations Convention on the Law of the Sea (UNCLOS) - Annex I (highly migratory species).
- Species of Principal Importance (England and Wales).
- OSPAR - Annex V.

14.2.4 Guidelines and Protocols

The Joint Nature Conservation Committee (JNCC) has helped develop a number of tools to assist in assessing potential impacts to marine mammals in the UK EEZ and developing mitigation protocols.

The protection of marine European Protected Species from injury and disturbance: Guidance for the marine area in England and Wales and the UK offshore marine area (JNCC, 2010), is a guidance document prepared by the JNCC, Natural England and the Countryside Council for Wales (now part of Natural Resources Wales (NRW)). It describes protection status, legal background and provides guidance on offences ie deliberate injury and disturbance. It outlines a risk assessment approach, the licence assessment process, and activities (notably construction works and decommissioning, drilling, use of explosive, dredging/dumping, offshore renewables, research on cetaceans, shipping and vessel movements). It also identifies the common and less common cetacean species in the UK EEZ and marine turtles. Annex A, B, and C include the JNCC guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys, the protocol for minimising the risk of injury to marine mammals from piling noise and guidelines when using explosives.

JNCC notes that other protected fauna, for example marine turtles, occur in waters where their guidelines may be used, and suggest that, whilst the appropriate mitigation may require further investigation, the protocols recommended for marine mammals would also be appropriate for marine turtles and basking shark.

14.2.5 Desktop Studies

A desk-study has been undertaken to inform the assessment presented within this chapter. This has included a systematic gathering and review of grey and peer-reviewed literature of freely available documents, that included *inter alia*:

- Hammond et al (2017) - Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys;
- Reid, J B, Evans, P G H, and Northridge, S P (2003) - Atlas of Cetacean distribution in north-west European waters. Joint Nature Conservation Committee, Peterborough;
- Russell and McConnell (2014) - Seal at-sea distribution, movements and behaviour. Report to DECC. URN:14D/085 March 2014 (final version). Sea Mammal Research Unit, University of St Andrews;

- Botterell ZLR, Penrose R, Witt MJ, Godley BJ (2020) - Long-term insights into marine turtle sightings, strandings and captures around the UK and Ireland (1910– 2018). Journal of the Marine Biological Association of the United Kingdom;
- Witt et al (2012) - Basking sharks in the northeast Atlantic: spatio-temporal trends from sightings in UK waters;
- Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Appendix B – VMS Fishing analysis. Ref. no. A3728-RTE-AP-2, Rev. 1. January 2016. Report prepared for EirGrid and RTE by Anatec Limited;
- International Council for Exploration of the Sea (ICES) - ecosystem data portal (https://ecosystemdata.ices.dk/);
- Marine Management Organisation (MMO) - United Kingdom commercial sea fisheries landings by Exclusive Economic Zone of capture: 2012-2018;
- MMO - Landings data by Exclusive Economic Zone for all UK registered vessels 2016 and 2012-2018;
- MMO - UK Sea Fisheries Statistics 2016;
- NBN Atlas - species database (https://species.nbnatlas.org);
- Ellis et al (2012). Spawning and nursery grounds of selected fish species in UK waters; and
- European Seabirds at Sea (ESAS) database (maintained by the JNCC, also covering marine mammals).

14.2.6 Designated Sites and Search Areas

Designated sites associated with marine environments (namely Special Areas of Conservation (SACs) and Special Protection Areas (SPAs)) have been identified within varying distances to the Project site for habitat features and within specific search areas associated with different mobile features. These search areas for mobile features were as follows:

- For cetaceans, consideration was given to Marine Mammal Management Units (MU). MUs were established by the JNCC (JNCC, 2015), with the aim of enabling identification of plans and projects, which should be considered in impact assessments for the seven most common cetacean species within and adjacent to the UK EEZ. The Project has considered designated sites with cetaceans listed as a primary reason for site selection, and/or, as a qualifying feature within 300km of the Project area;
- For seals, search areas were focused on foraging ranges, using typical distances of 120km for harbour seal, and 145km for grey seal (SMRU, 2011 and Thompson et al 1996, respectively). The Project has considered designated sites with seals listed as a primary reason for site selection, and/or, as a qualifying feature within 300km of the Project area;
- For migratory fish, the Project has considered designated sites with migratory fish listed as a primary reason for site selection, and/or, as a qualifying feature within 200km of the Project area; and
- SPAs that are designated in full or in part by supporting seabird species that could interact with the Project were identified using the mean max foraging ranges published in Woodward et al. 2019.

Commented [A32]: Placeholder: Approach to be aligned with that contained within Volume 3D

14.2.7 Field Studies

Intertidal and Benthic Habitats and Ecology

Data on benthic habitats and fauna was gathered along the route of the Celtic Interconnector in two campaigns carried out in 2015 and 2018 respectively. Seabed acoustic surveys and geophysical surveys were undertaken, bathymetry was measured, and samples of benthos and sediment were taken both using a Hamon grab and seabed photography (stills and video). Over the course of the survey campaigns, data was collected from locations that are no longer under consideration (that is, data gathered to inform the optioneering stage), although the wider dataset is considered appropriate to inform this ER. Sediment composition was identified as the greatest factor influencing diversity of macrofaunal communities along the route (see Volume 4 Environmental Report for UK Offshore – Chapter 11: Marine Sediment Quality).

Marine Mammals and Reptiles

Marine mammal observers (MMOs) were operational onboard the 2014 and 2017 geophysical survey vessels. Throughout all works, suitably qualified MMOs followed guidelines established by the JNCC, recording continuously as appropriate, including deployment of passive acoustic monitoring (PAM) as required. The findings from this work have been incorporated into the baseline description.

Fish Ecology

No targeted fish surveys have been undertaken along the wider marine route of the Celtic Interconnector, also with no dedicated survey effort planned prior to the submission of the ER. The composition of fish populations in the UK EEZ have been drawn from sources referenced in Section 14.2.5 (Desktop Studies) and 14.8 (References).

Ornithology

In UK seas, no targeted surveys have been undertaken to identify seabirds commuting or foraging along the route of the Celtic Interconnector. Given the largely sub-surface nature of the Project and the extent of the third-party data available (ie ESAS database), no dedicated survey effort was considered necessary to inform this assessment.

14.2.8 Methodology for Assessment of Effects

Scope of the Assessment

The method for determining the scope of the assessment within the biodiversity chapter differs from that used in other technical chapters within this ER in order to correspond with topic specific guidance (ie CIEEM, 2018). However, the relevant receptors (ie ecological features), the spatial and the temporal scope are all defined in this section. The method has multiple stages enabling the scope of the assessment to be progressively refined.

Ecological Features

Scoping – Determining Importance

For this biodiversity assessment, the first stage in determining the scope of the assessment is to identify which ecological features identified through the desk study and field surveys (see Section 6.5) are 'important'[9] in the context of the Project. Following CIEEM (2018) guidance, the importance of ecological features is first determined with reference to legislation and policy and then with regard to the extent of habitat or size of population that may be affected by the Project.

As the importance of ecological features is determined with regard to the extent of habitat or size of population that may be affected by the Project, each status can differ from that which would be conferred by legislative protection or identification as a conservation notable species.

Wherever possible, information regarding the extent and population size, population trends and distribution of the ecological features has been used, to inform the categorisation of importance at the Project level. Where detailed criteria or contextual data were not available, professional judgement was used to determine importance.

The following geographical scale has been used within the assessment:

[9] Importance relates to the quality and extent of designated sites and habitats, habitat/species rarity and its rate of decline. Ecological features that are not considered to be important are those that are sufficiently widespread, unthreatened and resilient and with populations that will remain viable and sustainable irrespective of the Project.

- **European** – eg SACs, SPAs, or candidate sites, or areas that support habitats or species great enough in extent/number to qualify as European sites even if not designated;
- **National** – eg National Nature Reserves (NNR), areas that support habitats or species great enough in extent/number to qualify as NNR even if not designated or contribute significantly to the objectives in the UK Biodiversity Action Plan (BAP), or UK Post-2010 Biodiversity Framework;
- **County** – eg habitats or species present that may contribute significantly to the objectives in, for example, the Scilly Biodiversity Audit;
- **Local** – eg habitats, red listed flora and fauna and legally protected species that based on their extent, population size, quality etc are determined to be at a lesser level of importance than the geographic contexts above;
- **Negligible** – eg common and widespread semi-natural habitats and species that do not occur in levels elevated above those of the surrounding area and areas of heavily modified or managed land uses (eg hard standing used for car parking, as roads etc.).

A justification of all determinations of importance are provided in Table 14.5.

Where protected species are present and there is the potential for a breach of the legislation, those species should always be considered as ‘important’ features. With the exception of such species receiving specific legal protection, or those subject to legal control (eg invasive species), all ecological features that were determined to be important at negligible level have been scoped out of the assessment at this stage. Further, ecological features of local importance, where there was a specific technical justification, were also scoped out at this stage. This is because effects on them would not influence the decision-making about whether, or not consent should be granted for the Project (in other words a significant effect in EIA terms could not occur). This approach is consistent with that described in CIEEM (2018). Specific justification for exclusion of each of these ecological features is provided in Table 14.5.

All legally protected species and ecological features that are of sufficient importance were then taken through to the next stage of the assessment.

Spatial Scope

The installation and operation phases of the Project may result in the following environmental changes that could significantly affect ecological features/receptors:

- Habitat loss or degradation;
- Introduction and/or spread of invasive and non-native species (INNS);
- Increased suspended sediment concentrations;
- Deposition of sediments (smothering);
- Accidental loss of pollutants or disturbance of pollutants already present;
- Increased light, noise and vibration (disturbances);

- Increased vessel movements; and
- Creation of heat and electro-magnetic fields (EMFs).

The key to establishing which environmental changes may result in likely significant effects, is the determination of a Zone of Influence (ZoI.) for each important ecological feature identified. ZoIs differ depending on the type of environmental change (i.e. the change from the existing baseline) as a result of the Project and the ecological feature being considered.

The most straightforward ZoI to define is the area affected by land-take and direct land-cover changes associated with the Project. This ZoI. is the same for all affected ecological features.

By contrast, for each environmental change that can extend beyond the area affected by land-take and land-cover change (eg increased noise associated with installation activities within the land-take area), the ZoI may vary between ecological features, dependent upon their sensitivity to the change and the precise nature of the change. For example, a ringed plover *Charadrius hiaticula* might only be significantly disturbed by noise generated very close to its nest site, while a minke whale might be disturbed by underwater noise generated at a much greater distance, and other species (eg many invertebrates) may be unaffected by changes in noise. In view of these complexities, the definition of the ZoI. that extends beyond the land-take area was based upon professional judgement informed by a review of published evidence where available (eg disturbance criteria for various species) and discussions with the technical specialists who are working on other chapters of the Environmental Report.

It should be noted that the avoidance of potentially significant effects through the design process are implicitly taken into account through the consideration of each ZoI, as are standard installation practices that are commonplace. When scoping in or out ecological features from further assessment, environmental measures (see Section 6.8) associated with general good practice that are described within the Code of Construction Practice (see REFERENCE TO ADD) have been taken into account (eg pollution controls etc.).

[Decommissioning text to be added here]

Temporal Scope

The temporal scope of the biodiversity assessment is consistent with the period over which the development would be carried out and therefore covers the installation and operational periods, ie installation of the offshore cable route commencing in 2024, and the project becoming fully operational in 2027 for an estimated period of 40 years.

Significance Evaluation Methodology

CIEEM (2018) defines a significant effect as one “that either supports or undermines biodiversity conservation objectives for ‘important ecological features’ or for biodiversity in general”.

When considering potentially significant effects on ecological features, whether these be adverse or beneficial, the following characteristics of environmental change are taken into account[10]:

- **Extent** – the spatial or geographical area over which the environmental change may occur;
- **Magnitude** – the size, amount, intensity or volume of the environmental change;
- **Duration** – the length of time over which the environmental change may occur;
- **Frequency** – the number of times the environmental change may occur;
- **Timing** – the periods of the day/year etc. during which an environmental change may occur; and
- **Reversibility** – whether the environmental change can be reversed through restoration actions.

Magnitude of Change

Although the characteristics described above are all important in assessing effects by using information about the way in, which habitats and species are likely to be affected, a scale for the magnitude of the environmental change, as a result of the Project, has been described in Table 14.2. This provides an understanding of the relative change from the baseline position, be that adverse or beneficial changes.

Table 14.2 Guidelines for impact magnitude

Magnitude/Scale of change	Criteria and resultant effect
High	The change permanently (or over the long-term) affects the conservation status of a habitat/species, reducing or increasing the ability to sustain the habitat or the population level of the species within a given geographic area. Relative to the wider habitat resource/species population (eg a local or national population), a large area of habitat or large proportion of the wider species population is affected. For designated sites, integrity is compromised. There may be a change in the level of importance of the receptor in the context of the Project.
Medium	The change permanently (or over the long term) affects the conservation status of a habitat/species reducing or increasing the ability to sustain the habitat or the population level of the species within a given geographic area. Relative to the wider habitat resource/species population, a small-medium area of habitat or small-medium proportion of the wider species population is

10 The definitions of the characteristics of environmental change are based on the descriptions provided in CIEEM 2018. Other chapters in this ES may use some of the same terms albeit with a different definition.

Magnitude/Scale of change	Criteria and resultant effect
	affected. There may be a change in the level of importance of this receptor in the context of the Project.
Low	The quality or extent of designated sites or habitats or the sizes of species' populations, experience some small-scale reduction or increase. These changes are likely to be within the range of natural variability and they are not expected to result in any permanent change in the conservation status of the species/habitat or integrity of the designated site. The change is unlikely to modify the evaluation of the receptor in terms of its importance.
Very Low	Although there may be some effects on individuals or parts of a habitat area or designated site, the quality or extent of sites and habitats, or the size of species populations, means that they would experience little or no change. Any changes are also likely to be within the range of natural variability and there would be no short-term or long-term change to conservation status of habitats/species receptors or the integrity of designated sites.
Negligible	A change, the level of which is so low, that it is not discernible on designated sites or habitats or the size of species' populations, or changes that balance each other out over the lifespan of a Project and result in a neutral position.

Determining Significance – Adverse and Beneficial Effects

Adverse effects are assessed as being significant if the favourable conservation status of an ecological feature would be lost as a result of the Project. Beneficial effects are assessed as those where a resulting change from baseline improves the quality of the environment (eg increases species diversity, increases the extent of a particular habitat etc., or halts or slows down an existing decline). For a beneficial effect to be considered significant, the conservation status would need to positively increase in line with a magnitude of change of "high" as described in Table 14.2.

Conservation status is defined as follows (as per CIEEM, 2018):

- "*For habitats, conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and typical species within a given geographical area; and*
- *For species, conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area*".

The decision as to whether the conservation status of an ecological feature would alter has been made using professional judgement, drawing upon the information produced through the desk study, field survey and assessment of how each feature is likely to be affected by the Project.

A similar procedure is used where designated sites may be affected by the Project, except that the focus is on the effects on the integrity of each site; defined as:

"The coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified".

The assessment of effects on integrity draws upon the assessment of effects on the conservation status of the features for which the site has been designated.

14.2.9 Difficulties Encountered

There were no difficulties encountered in the preparation of this assessment.

14.3 Receiving Environment

14.3.1 Designated Sites (Natura 2000)

A number of European sites that support mobile species that could interact with the Celtic Interconnector Project have been identified. Full details of these sites and designated features are provided in Appendix XX.

Commented [A33]: Placeholder: Appendices for ER are in preparation, and will be submitted with the final Application File.

Special Areas of Conservation (SACs)

The following SACs (within 300km) are designated for populations of marine mammals in the UK and could potentially interact with the Celtic Interconnector Project. These include SACs supporting bottlenose dolphin, harbour porpoise, and grey seal on the west coast of the UK and taking into account the MUs for these species, as highlighted above:

- Isles of Scilly complex SAC (grey seal as a qualifying feature);
- Bristol Channel Approaches / Dynesfeydd Mor Hafren SAC (harbour porpoise as a primary reason for site selection);
- Pembrokeshire Marine / Sir Benfro Forol SAC (grey seal as a primary reason for site selection);
- West Wales Marine / Gorllewin Cymru Forol SAC (harbour porpoise as a primary reason for site selection);
- Cardigan Bay / Bae Ceredigion SAC (bottlenose dolphin as a primary reason for site selection and grey seal as a qualifying feature);
- Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC (bottlenose dolphin and grey seal as qualifying features);
- North Anglesey Marine / Gogledd Mon Forol SAC (harbour porpoise as a primary reason for site selection); and
- North Channel SAC (harbour porpoise as a primary reason for site selection).

The following SACs (within 200km) are designated for populations of migratory fish in the UK and could potentially interact with the Celtic Interconnector Project. These SACs notably support anadromous populations Atlantic salmon *Salmo salar,* allis shad *Alosa alosa,* twaite shad *Alosa fallax* and sea lamprey *Petromyzon marinus,* on the south west coast of England:

- Fal and Helford SAC (site evaluation and presence of allis shad and twaite shad);
- River Camel SAC (Atlantic salmon as a qualifying feature and site evaluation and presence of twaite shad and sea lamprey);
- Plymouth Sound and Estuaries SAC (allis shad as a qualifying feature and site evaluation and presence of twaite shad and sea lamprey);
- Adonydd Cleddau_Cleddau Rivers SAC (sea lamprey as a qualifying feature and site evaluation and presence of allis shad and Atlantic salmon); and
- Pembrokeshire Marine / Sir Benfro Forol SAC (sea lamprey, allis shad and twaite shad as qualifying features).

Figures 14.1 and 14.2 below illustrate the referenced SACs for marine mammals and migratory fish within 300km and 200km of the Project area respectively.

Figure 14.1 European Sites - Marine Mammals (within 300km of the Project area)

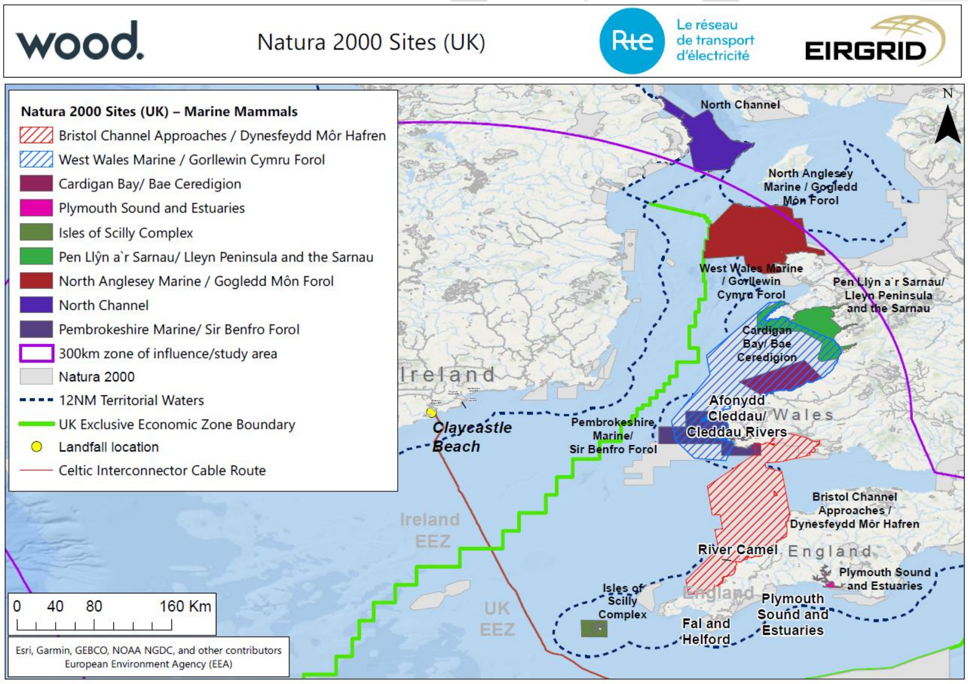
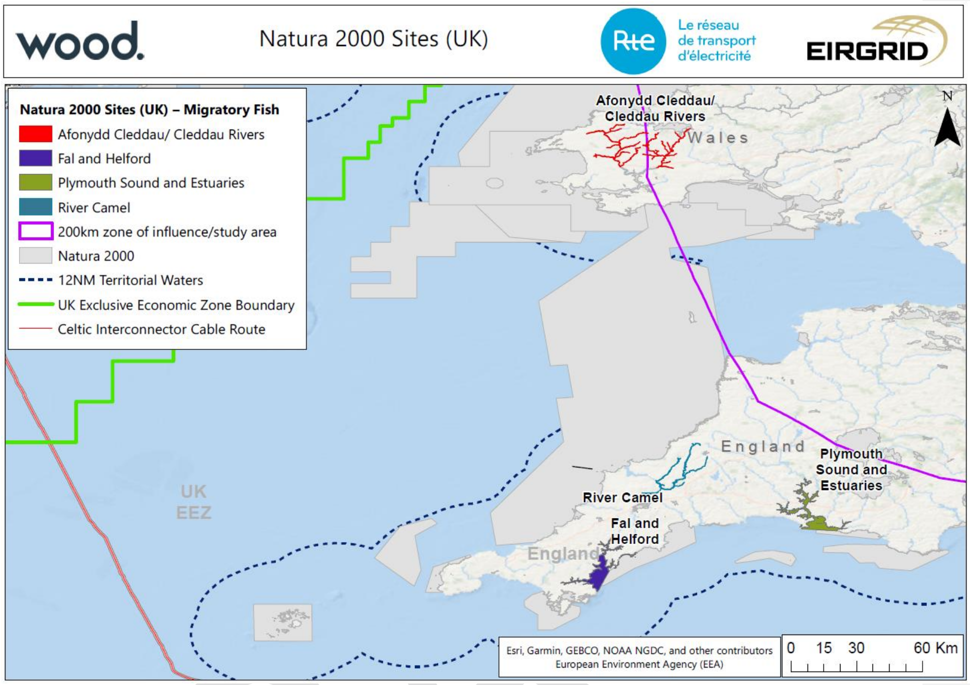


Figure 14.2 Natura 2000 Sites - Migratory Fish (within 200km of the Project area)



Special Protection Areas (SPAs)

The following SPAs are designated for populations of birds that could potentially interact with the Celtic Interconnector Project. The following six sites have been identified, with the designated interest features that could interact with the Project shown in brackets:

- Grassholm SPA (Northern gannet *Morus bassanus*);
- Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA (European storm petrel *Hydrbates pelagicus*, Manx shearwater *Puffinus puffinus*, lesser black-backed gull *Larus fuscus*, Atlantic puffin *Fratercula arctica*);
- Isles of Scilly SPA / Ramsar site (European storm petrel, Lesser black-backed gull);
- St Kilda SPA (Manx shearwater);
- Rum SPA (Manx shearwater); and
- Copeland Islands SPA (Manx shearwater).

14.3.2 Benthic Habitats and Ecology

Within the UK EEZ, detailed surveys conducted during 2015 identified a range of habitats along the cable corridor, as presented in Figure 14.3. A detailed description of the seabed from a physical perspective is presented in Volume 4 Environmental Report for UK Offshore – Chapter 11: Marine Sediment Quality and Chapter 12: Marine Physical Processes. In summary, surface sediments were found to be generally characterised by very fine to very coarse sands, with occasional pebbles and gravels. The dominant sediment type present was gravelly muddy sand (as per Folk, 1954), with maximum levels of ~98% sand recorded from samples within the UK EEZ.

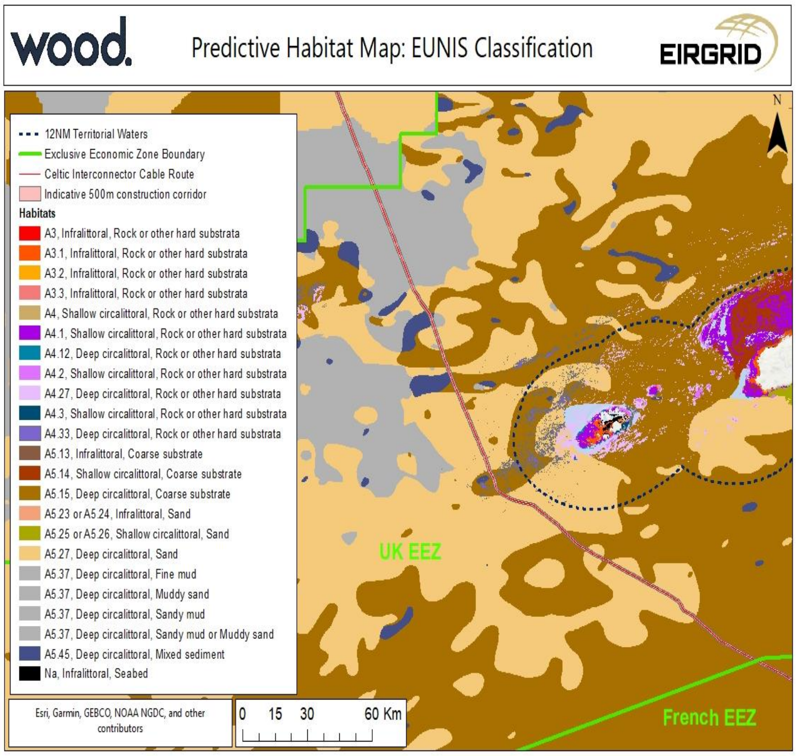
Table 14.3 presents the habitats that were recorded along the route of the Celtic Interconnector in Irish Waters.

Table 14.3 Habitats Along the Route of the Celtic Interconnector in the UK EEZ

EUNIS Code	Biozone	Substrate	Length present along cable route (km)
A4.33	Deep circalittoral	Rock or other hard substrata	0.4
A5.15	Deep circalittoral	Coarse substrate	56.9
A5.27	Deep circalittoral	Sand	109.6
A5.37	Deep circalittoral	Sandy mud or muddy sand	37.9
A5.45	Deep circalittoral	Mixed sediment	6.2

The distribution of these, and other habitats in the vicinity of the Celtic Interconnector, is shown in Figure 14.3.

Figure 14.3 Predictive Habitat Map of EUNIS Classifications within the UK EEZ



The habitats identified through detailed surveys of the cable route are associated with a number of intertidal and subtidal communities.

- A4.33: Faunal communities on deep, low energy circalittoral rock;
- A5.15: Deep circalittoral coarse sediment: Deepwater habitats of this nature are more diverse than their shallow counterparts and are generally characterised by in-faunal polychaete and bivalve species;
- A5.27: Deep circalittoral sand: As above, generally more diverse than their shallow counterparts, characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms;
- A5.37: Deep circalittoral mud: Depending on the level of silt/clay and organic matter, a variety of faunal communities may develop within the habitat, with communities typically dominated by polychaetes, and with high numbers of bivalves, echinoderms and foraminifera; and
- A5.45: Deep circalittoral mixed sediments: Generally highly diverse habitats, with a high number of in-faunal polychaetes and bivalve species.

There were no habitats categorised as environmentally-sensitive recorded along the cable route, or in the immediate vicinity, nor does the Celtic Interconnector route pass through any sites either designated, or under consideration for designation, for benthic habitats.

14.3.3 Marine Mammals

The Celtic and Irish Seas support a variety of marine mammals, including cetaceans and seals. Around thirty different cetacean species have been recorded in the UK EEZ, with the most commonly recorded of these being common bottlenose dolphin (including a resident population within Cardigan Bay, Wales) and harbour porpoise. Other species recorded in the Project area include minke whale, sei whale and short-beaked common bottlenose dolphin (Hammond et al, 2017 and Reid et al, 2003).

As well as sightings, records of strandings are a useful indicator of cetacean presence in an area. In the UK, the Cetacean Strandings Investigation Programme (CSIP) coordinates the investigation of all strandings, which occur around the UK coastline. Between 2011 and 2015 it was reported that the most frequently-recorded stranded cetacean species were harbour porpoise, short-beaked common dolphin, long-finned pilot whale *Globicephala melas*, minke whale and white beaked dolphin *Lagenorhynchus albirostris* (Deaville et al, 2015).

Both grey and common seals are also present in the UK EEZ, with populations present year-round, as well as regularly passing between UK and Irish waters. It is estimated that there are around 120,000 grey seals in Britain, representing approximately 40% of the world’s population. The British harbour seal population is estimated at between 48,000 and 56,000 individuals, with both species granted strict protection under the Conservation of Seals Act 1970, in particular during their breeding season (June/July for harbour seal, and September/October for grey seal in the area).

During the 2017 MMO surveys, October-November 2017, a total effort of just under 136 hours of surveys was undertaken, recording 18 sightings of an estimated 92 individual animals and comprising four species: harbour porpoise, short-beaked common bottlenose dolphin, Atlantic white-sided dolphin *Lagenorhynchus acutus* and grey seal. A number of unidentified dolphins were also recorded. Across all MMO surveys along the route of the Celtic Interconnector, species were recorded in water depths ranging from 7.3m to 77.6m.

14.3.4 Marine Turtles

Botterell et al (2020) provides long-term insights into marine turtle sightings, strandings and captures around the UK and Ireland (1910–2018). From this work, records of hard-shell turtles, including loggerhead and Kemp’s ridley turtles significantly increased over time, then notably decreased recently. Sightingsgenerally occurred on the western aspects of the UK and Ireland. Similarly, the majority of strandings and sightings of leatherback turtles occurred on the western aspects of the UK and the entirety of Ireland’s coastline, also recently their annual records have decreased. The majority of records of hard-shell turtles were juveniles and occurred in the boreal winter months (Dec-Apr). The leatherback turtles were most commonly recorded in the boreal summer months (Jun-Oct) and were adult sized. The cause of the recent annual decreases is unclear, however, changes to overall population abundance, prey availability, anthropogenic threats and variable reporting effort could all contribute.

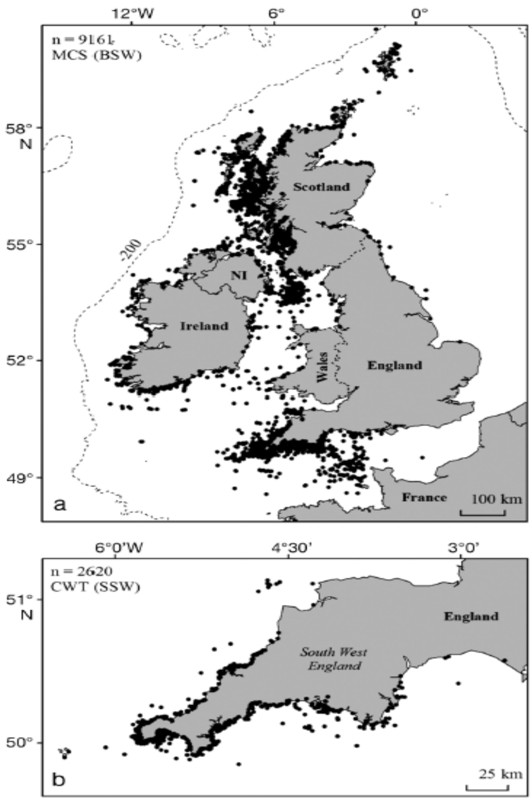
The Irish Sea Leatherback Turtle Project (2003-2006) was established to increase knowledge of leatherback turtles in the waters around Wales and Ireland. Work included tracking of turtles to understand their movements, and aerial surveys of their primary food source: jellyfish. Individuals migrate to the waters off Western Europe to feed and are well-adapted for conditions within the Celtic Sea. Of a total of 682 records of leatherback turtles recorded between 1960 and 2004 in Irish waters and the UK EEZ, around 75% were within the UK EEZ.

14.3.5 Basking Shark

Witt et al (2012) analysed 11,781 records (from 1988 to 2008) from 2 public recording databases operating in the UK. The authors described 3 sightings hotspots, including the southwest of England, and highlight the marked seasonality of basking shark sightings, which were at their greatest during the northeast Atlantic summer (June to August). They further highlight the significant correlation between the duration of the sightings season in each year and the North Atlantic Oscillation, which is an atmosphere-ocean climate oscillation, that has been linked to forcing marine ecosystems. Their analysis of reported body size data indicated that the annual proportion of small sharks (<4m length) sighted by the public decreased, the proportion of medium-sized sharks (4-6m) increased, and the proportion of large sharks sighted (>6m) remained constant. These patterns may be indicative of a population recovery following systematic harvesting in the 20th century.

Figure 14.4 from Witt et al (2012) shows the spatial distribution of basking shark sightings records (1988 to 2008) around the UK and Ireland, with particular focus on the south-west coast of England. The locations are illustrated with black dots and the original data sources came from the Basking Shark Watch (BSW), which is a database operated by the Marine Conservation Society (MCS), and the Seaquest Southwest database hosted by the Cornwall Wildlife Trust. The broken line indicates a 200m isobath.

Figure 14.4 Spatial Distribution of Basking Shark Sightings Records (1988 to 2008).



14.3.6 Demersal and Pelagic Fish (Commercial)

The MMO provide extensive commercial sea fisheries landings data for commercial fish species within the Project area (ranging from 2012-2018). These data are presented for the UK EEZ and split per ICES Division and Sub-division and have been assessed in the Volume 4 Environmental Report for UK Offshore – Chapter 20: Commercial Fisheries.

Key Demersal and Pelagic Species

The key demersal species identified in Volume 4 Environmental Report for UK Offshore – Chapter 20: Commercial Fisheries. include monk or monk or anglerfish *Lophius piscatorius*; common sole *Solea solea*; European plaice *Pleuronectes platessa*; turbot *Scophthalmus maximus*; European sea bass *Dicentrarchus labrax*; lemon sole *Microstomus kitt*; European hake *Merluccius merluccius*; brill *Scophthalmus rhombus*, john dory *Zeus faber* and pollack *Pollachius pollachius*.

The key pelagic species identified in Volume 4 Environmental Report for UK Offshore – Chapter 20: Commercial Fisheries.include European pilchard *Sardina pilchardus*; Atlantic mackerel *Scomber scombrus*; European anchovy *Engraulis encrasicolus*; European sprat *Sprattus sprattus* and horse mackerel *Sarda sarda*.

14.3.7 Spawning and Nursery Grounds (Marine Fish)

Ellis et al (2012) provide an evidence-based understanding of the distribution of fish spawning and nursery grounds, and other ecologically important fish habitats in the UK EEZ. Data collection within this work was based on the distribution of fish eggs, larvae and juvenile fish.

In 2010, fish with nursery grounds (low intensity per ICES Sub-division) in the Project area included spurdog *Squalus acanthias;* common skate *Dipturus batis-complex;* whiting *Marlangius merlangus*; blue whiting *Micromesistius poutassou*; ling *Molva molva* and European hake *Merluccius merluccius.* Fish with nursery grounds (high and low intensity combined) included monk or anglerfish and Atlantic mackerel. Fish with nursery grounds (larvae only) included European plaice.

In 2010, fish with spawning grounds (eggs, larvae, spawning grounds and low intensity) included cod *Gadus morhua;* whiting; ling, European hake, horse mackerel, sandeels *Ammodytidae,* Atlantic mackerel, common sole. Fish with spawning grounds (larvae only) included monk or anglerfish. In 1998, fish with spawning grounds included European plaice, common sole.

14.3.8 Spawning Timings and Season (Key Marine Species)

The general timings, of the spawning season for the species, that are known to spawn in the Project area, are presented in Table 14.4.

Table 14.4 Spawning Season of Key Species in the Project Area (per ICES Sub-division)

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Source
Cod		x	x										
Whiting													
Ling													
European hake		x	x										
Horse mackerel					x	X							
Atlantic mackerel					x	X							
Common sole				x									
Monk or Anglerfish													
European plaice	x	x											

X = peak spawning period

14.3.9 Migratory Fish (Natura 2000 and Offshore)

As presented in Section 14.3.1, five SACs (within 200km) are designated for populations of migratory fish (see Figure 14.2). These SACs notably support anadromous populations of Atlantic salmon, allis shad, twaite shad and sea lamprey on the south west coast of England, with all species that are protected under the EU Habitats Directive, with Atlantic salmon (Annex II and V), allis and twaite shad (Annex V) and sea lamprey (Annex II). The purpose of these SAC designations is to maintain or, where appropriate, restore their populations to a favourable conservation status in their natural range.

European eel *Anguilla anguilla* is protected under the NERC Act 2006 (Sections 41 and 42) and listed as a priority species (UK BAP species_2007) and by the IUCN (2001) as critically endangered (current). The fish frequents coastal waters and freshwater systems around the UK, including around the Isle of Scilly, and it is likely that they will frequent the waters of the Project area during their offshore migrations.

14.3.10 Ornithology

In the offshore area, published data demonstrates that a wide range of seabirds are regularly recorded in the area and or have the potential to occur in the area, based on direct observation and modelled distributions of seabirds. Species that could occur, during both the breeding and non-breeding season include Manx shearwater, Northern gannet, fulmar, Atlantic puffin, lesser black-backed gull and European storm petrel. Sources include:

- DEFRA (2017) – Risk assessment of seabird bycatch in UK Waters. *Research project MB0126*; and
- European Seabirds at Sea (ESAS) database coordinated by the Joint Nature Conservation Committee (JNCC).

The cable route occupies a very small area of the seabed in comparison with the potential foraging ranges of the species identified. Whilst there is potential for seabirds to occur along the proposed cable route their presence would most likely be transient in nature as birds forage or migrate through the wider area. Modelled distributions (DEFRA 2017) suggest that species associated with the Scilly Isles SPA/Ramsar such as European storm petrel and lesser black-backed gull may forage to the west of the islands, however such species are surface feeders and not likely to interact with the with cable route.

14.4 Mitigation / Embedded Measures Section

Commented [A34]: Placeholder: All mitigation measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

Throughout works to install both the cable itself, and associated external rock protection, a number of embedded mitigation measures have been incorporated into project design. Mitigation measures specific to the biodiversity aspects of the assessment include:

- Project-related vessels to be operated in line with IMO Guidelines for the reduction of underwater noise to address adverse impacts on marine life;
- Operations in the UK marine environment will be undertaken in line with JNCC's 'Guidelines for minimising the risk of injury to marine mammals from geophysical surveys' (JNCC, 2017);
- Use of technology and techniques that limit noise propagation (in air and underwater);
- Project-related vessels will adhere to international best practise regarding pollution control, including the MARPOL Convention;
- Use of appropriate installation equipment, determined by seabed type, will be used, to minimise seabed disturbance, subsequent release of sediment into the water column, and indirect effects on benthic habitats and species; and
- Use of appropriate burial depths (target 1.8-2.5m) and heat shielding during cable installation will have the indirect effect of reducing environmental effects from heat emissions and electro-magnetic fields (EMF).

14.5 Scope of the Assessment

Ecological features that are scoped into the assessment (ie those of sufficient importance occurring within a relevant ZoI) are summarised in Table 14.5, along with a summary of the justification for inclusion. For each ecological feature presented, the potential environmental changes and significant effects resulting from the Project are provided.

Table 14.5 Likely Effects, ZoIs and Justification for Scoped-in Ecological Features

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
European Sites (SACs) that include marine mammal (300km) and migratory species (200km) as a designated feature, or assessed as present.	European	European	Not maintaining or restoring extent and distribution, populations, and distribution within the site of qualifying species, due to effects associated with underwater noise and EMFs (all phases).	Variable and dependent on species foraging ranges and migratory pathways.	Scoped out – assessment of potential impacts on European Sites is presented in Volume 4B Habitat Regulations Assessment (HRA) - Screening Report in full and concluded that no Likely Significant Effects would occur on any of the European sites identified.
European Sites (SPAs) that include bird species as a designated feature	European	European	Reduction in prey availability due to habitat change, suspended sediment or survey, installation or operational maintenance noise. Disturbance / displacement due to aural and visual stimuli. Direct toxic effects of pollutants including hydrocarbons through bioaccumulation in the	Variable dependent on species foraging range as identified in Woodward *et al* 2019	Scoped out – Assessment of potential impacts on European Sites is presented in Volume 4B Habitat Regulations Assessment (HRA)-Screening Report in full and concluded that no Likely Significant Effects would occur on any of the European sites identified.

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
			food chain or directly (e.g. oiling).		
Subtidal (benthic) Habitats and Species	N/A	Local	Disturbance to / loss of habitat as a result of installation works. Creation of new habitat in subtidal zone. Changes to water quality as a result of increased suspended sediment. Accidental pollution events reducing habitat quality or having direct toxic effects.	500m	Scoped in due to disturbance effects arising from the installation of the cable and external cable protection.
Marine Mammals (all groups)	European	Regional	Underwater noise and auditory injury/disturbance to marine mammals (all groups), due to support and installation vessel presence . Underwater noise and auditory injury/disturbance to marine mammals (all	Variable with species, sound source, level of disturbance and receiving environment.	Scoped in - underwater noise source levels from the support and install vessels, in Volume 4 Environmental Report for UK Offshore – Chapter 18: Noise and Vibration, indicate that their engines and dynamic positioning (DP), are below the levels that would require mitigation for marine mammals (180dB).

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
			groups), due to installation activity (cable laying with trenching and install of external cable protection). Underwater noise and auditory injury/disturbance to marine mammals (all groups), due to installation activity (unlikely need to detonate UXO during preparation for cable install). Underwater noise auditory injury/disturbance to marine mammals (all groups), due to subsea survey and monitoring equipment (all phases). EMFs.		Underwater noise source levels from, cable laying with trenching, and install of external cable, in Volume 4 Environmental Report for UK Offshore – Chapter 18: Noise and Vibration, indicate that they are below the levels that would require mitigation for marine mammals (180dB). UXO targets were scoped out of the ER because they are not expected along the cable route, also there is a commitment to best practice mitigation in the unlikely event that any are discovered. However, underwater noise source levels, from subsea survey and monitoring equipment, in Volume 4 Environmental Report for UK Offshore – Chapter 18: Noise and Vibration, indicate that they are above the levels that would require mitigation for marine mammals (240dB verses 180dB).

Commented [A35]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

Commented [A36]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
					EMFs are not considered to be significant based on the proposed cable protection (conductive sheathing) and burial depth of 1.8-2.5m (increasing distance from the cable and the marine mammal receptors, thereby reducing the effect).
Marine Turtles	European	Regional	Underwater noise and auditory injury/disturbance to marine turtles, due to support and installation vessel presence. Underwater noise and auditory injury/disturbance to marine turtles, due to installation activity (cable laying with trenching and install of external cable protection). Underwater noise and auditory injury/disturbance to marine turtles, due to installation activity	Variable with species, sound source, level of disturbance and receiving environment.	Scoped in – as an example, Lavender et al (2010, 2011) reported frequencies between 50-1000Hz for juvenile loggerhead turtles (yearlings to sub-adults). Underwater noise source levels from the support and install vessels, in Volume 4 Environmental Report for UK Offshore – Chapter 18: Noise and Vibration, indicate that their engines and dynamic positioning (DP), are at a level that is likely to trigger a behavioural response and may agitate marine turtles. The likely frequency banding from these vessels and the DPs, of 20Hz to 35kHz, is within the low/sensitive

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
			(unlikely need to detonate UXO during preparation for cable install). Underwater noise auditory injury/disturbance to marine turtles, due to subsea survey and monitoring equipment. EMFs		hearing range of marine turtles (especially within the Hz range). Also, constant low frequency noises from vessels compound the potential for an acoustic impact, including low-frequency masking eg acquisition of prey and avoidance of predators and vessel collisions. Underwater noise source levels from cable laying with trenching, and install of external cable, Volume 4 Environmental Report for UK Offshore – Chapter 18: Noise and Vibration, indicate that they are at a level that is likely to trigger a behavioural response, low-frequency masking and may agitate marine turtles. However, the likely frequency banding of 40-50kHz is just above the low/sensitive hearing range of marine turtles (especially at the 40kHz). UXO targets were scoped out of the Environmental Report because they are not expected along the cable

Commented [A37]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
					route (based on findings of previous surveys), also there is a commitment to best practice mitigation in the unlikely event that any are discovered. However, underwater noise source levels, from subsea survey and monitoring equipment, in Volume 4 Environmental Report for UK Offshore – Chapter 18: Noise and Vibration indicate that they are at a level that is likely to trigger a behavioural response and agitate marine turtles. There are almost no data on the effects of intense sounds on marine turtles and, thus, it is difficult to predict the level of damage to hearing structures at the associated peak level of 240dB. The likely frequency banding from the subsea survey and monitoring equipment, of 300Hz to 500kHz, is within the low/sensitive hearing range of marine turtles (especially within the Hz range). Also, constant low frequency noises from vessels and

Commented [A38]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
					seismic survey activity compound the potential for an acoustic impact, including low frequency masking eg acquisition of prey and avoidance of predators and vessel collisions. The more likely source of damage would be barotrauma as a result of the impulsive energy produced (especially if marine turtles are within close range to the works). EMFs are not considered to be significant based on the proposed cable protection (conductive sheathing) and burial depth of 1.8-2.5m (increasing distance from the cable and the marine turtle receptors, thereby reducing the effect).
Basking shark	European	National	Underwater noise and auditory injury/disturbance to basking shark, due to support and installation vessel presence. Underwater noise and auditory injury/disturbance	Variable with sound source, level of disturbance and receiving environment.	Scoped in – elasmobranchs possess only inner ear labyrinths and they are devoid of many of the accessory organs often found in bony fishes, such as a swim bladder. This may limit the ability of at least some species to detect the pressure

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
			to basking shark, due to installation activity (cable laying with trenching and install of external cable protection). Underwater noise and auditory injury/disturbance to basking shark, due to installation activity (unlikely need to detonate UXO during preparation for cable install). Underwater noise auditory injury/disturbance to basking shark, due to subsea survey and monitoring equipment. EMFs		component of sound, implying that the particle motion aspect is likely to be considered the primary stimulus for perceiving a sound field (Myrberg 2001; Casper & Mann 2006). Audiograms were calculated for five elasmobranch species (reviewed in Casper & Mann 2009), with most of the sensitivity occurring at low frequencies. The hearing bandwidth for elasmobranchs is from ~20Hz up to 1kHz, although 20Hz was the lowest frequency tested (Casper et al. 2012). Underwater noise source levels from the support and install vessels, in Volume 4 Environmental Report for UK Offshore – Chapter 18: Noise and Vibration, indicate that their engines and dynamic positioning (DP), are at a level that is possible to mask acoustic signals. Even though basking shark do not vocalise, or rely on hearing to forage, masking may increase potential to avoid predators

Commented [A39]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
					and collision from vessels. The likely frequency banding from these vessels and the DPs, of 20-35Hz, is within the low/sensitive hearing range of basking shark. Underwater noise source levels from cable laying with trenching, and install of external cable, in Volume 4 Environmental Report for UK Offshore – Chapter 18: Noise and Vibration, indicate that they are at a level that is possible to mask acoustic signals and may increase potential to avoid predators and collision from vessels. The likely frequency banding of 40-50kHz is within the low/sensitive hearing range of basking shark. UXO targets were scoped out of the ER because they are not expected along the cable route, also there is a commitment to best practice mitigation in the unlikely event that any are discovered. However, underwater noise source levels, from

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
					subsea survey and monitoring equipment, in Volume 4 Environmental Report for UK Offshore – Chapter 18: Noise and Vibration, indicate that they are at a level that is likely to cause impact, behavioural disturbance and mask acoustic signals. There is currently no existing data on the effects of intense sounds on elasmobranchs (Casper et al, 2012) and, thus, it is difficult to predict the level of damage to hearing structures at the associated peak 240dB level. It is possible that subsea survey and monitoring equipment could produce sounds at levels sufficient enough to yield hearing damage in the form of temporary threshold shift (TTS), resulting in a short-term decrease in auditory sensitivity (Casper et al. 2012). At this time, however, it is not known what these levels may be. There have been a limited number of studies that have examined the

Commented [A40]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
					effects of exposure to anthropogenic sound sources in species of elasmobranch (Casper et al. 2012). There is some experimental evidence that assessed the behavioural responses of sharks to sound (reviewed in Casper et al. 2012), in which loud, sudden onset sounds (20-30dB above ambient noise levels) would result in startling sharks from an area, although reportedly sharks would habituate to the stimuli after a few trials. The likely frequency banding from the subsea survey and monitoring equipment, of 300Hz to 500kHz, is within the low/sensitive hearing range of elasmosbranchs (especially in the Hz range). The more likely source of damage would be barotrauma as a result of the impulsive energy produced. Recent evidence (Casper et al. 2012) suggests that some of the barotrauma damage found in teleosts

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
					when exposed to high impulse stimuli is focused in the liver, kidneys, and intestines, and while elasmobranchs were not used in that study, they have many similarities in morphology with those species (eg they have the same organs as teleosts). Therefore, we consider that this study is indicative of the potential impacts of barotrauma on basking shark. EMFs are not considered to be significant based on the proposed cable protection (conductive sheathing) and burial depth of 0.8-2.5m (increasing distance from the cable and the basking shark receptor, thereby reducing the effect).
Fish Ecology (key demersal and pelagic species) **Fish Ecology (key spawning**	Regional	Local Regional	Disturbance to fish and their seabed habitats (soft and hard sediment areas) during installation phase). Disturbance to fish and their spawning and nursery grounds (as per	Variable with species, sound source, level of disturbance	Scoped in – during <u>cable laying and trenching operations</u> disturbance to fish and their seabed habitats (soft and hard sediment areas) will be required. This will come in the form of cut and cover and rock placement/mattressing (as required).

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
and nursery species)	Regional		ICES and Ellis et al, 2012) during installation and decommissioning phases). Underwater noise and auditory injury/disturbance to fish, due to support and installation vessel presence (all phases). Underwater noise and auditory injury/disturbance to fish, due to installation activity (cable laying with trenching and install of external cable protection). Underwater noise and auditory injury/disturbance to fish, due to installation activity (unlikely need to detonate UXO during preparation for cable install). Underwater noise auditory injury/disturbance to fish,	and receiving environment.	During installation and decommissioning phases disturbance to fish and their spawning and grounds. As identified in Section 1.3.7 these come with varying intensities and seasonality for the key species identified within the Project area (Jan to Aug inclusive). These grounds have largely been determined by presence of mobile adult fish (sometimes egg carrying or live-bearing), juvenile fish (densities), planktonic eggs and larvae (ichthyoplankton) within the water column. Underwater noise source levels from the support and install vessels, in Volume 4 Environmental Report for UK Offshore – Chapter 18: Noise and Vibration, indicate that their engines and dynamic positioning (DP), are below the levels that would require mitigation for fish. Using examples of cod, herring and Atlantic salmon, hearing bandwidth

Commented [A41]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
			due to subsea survey and monitoring equipment (installation, operation and decommissioning phases). EMFs		ranges are cod 10-800Hz, herring 20-4,000Hz and Atlantic salmon 10-400Hz and threshold at peak frequencies are cod 63-95dB, herring 75dB and Atlantic salmon 95dB (from Nedwell et al., 2004 and Nedwell and Howell, 2004). TTS in fishes are reviewed in Popper and Hastings (2009) and the authors suggest that TTS after long-term exposure to sounds that are as high as 170-180dB. This applying to species that have specialisations that result in their having relatively wide hearing bandwidths (to over 2kHz) and lower hearing thresholds than fishes without specialisations. Several studies show varying results for TTS, as a result of loud sounds, and recovery seems to be within 24hrs in most cases (Popper et al., 2005, 2007, Hastings et al., 2008 and Hastings and Miskis-Olds, 2011). UXO targets were scoped out of the ER because they are not expected

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
					along the cable route, also there is a commitment to best practice mitigation in the unlikely event that any are discovered. However, underwater noise source levels, from subsea survey and monitoring equipment, in Volume 4 Environmental Report for UK Offshore – Chapter 18: Noise and Vibration, indicate that they are at a level (240dB) that is likely to cause impact (mortality, physiological and TTS), masking and behavioural responses. The likely frequency banding from the subsea survey and monitoring equipment, of 300Hz to 500kHz, is within the bandwidth ranges of the selected species of demersal, pelagic and migratory fish (especially at the lower Hz and kHz levels). The more likely source of damage would be barotrauma as a result of the impulsive energy produced. Recent evidence (Halvorsen et al.

Commented [A42]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
					2012) suggests that some of the barotrauma damage found in teleosts when exposed to high impulse stimuli is focused in the liver, kidneys, and intestines. Therefore, we consider that this study is indicative of the potential impacts of barotrauma on species of demersal, pelagic and migratory fish. EMFs are not considered to be significant based on the proposed cable protection (conductive sheathing) and burial depth of 1.8-2.5m (increasing distance from the cable and the demersal, pelagic and migratory fish receptors, thereby reducing the effect).
Seabirds in the marine environment (all species, including gulls)	European	Local	Reduction in prey availability due to habitat change, suspended sediment or survey, installation or operational maintenance noise.	Variable dependent on species foraging range as identified in	Scoped out - The installation activities will be highly localized at any given point in time and occupy only a small fraction of the habitat available to seabirds for foraging. Levels of disturbance are akin to a very small increase in the usual

Ecological Feature	Importance – Legislation and Policy	Importance – Project	Environmental Changes and Likely Significant Effects	Zone of Influence	Relevant Assessment Criteria and Scoped-In / Out Justification
			Disturbance / displacement due to aural and visual stimuli. Direct toxic effects of pollutants including hydrocarbons through bioaccumulation in the food chain or directly (e.g. oiling).	Woodward *et al* 2019.	vessel traffic encountered in the area. Whilst the presence of the vessel deploying the cable may displace or attract individual birds, any effect would be highly localised and not result in observable changes in fitness of individual birds of any species. The risk of the loss of pollutants (including hydrocarbons and litter) from the vessels installing or maintaining the cable is low given the standard operating procedure for offshore works included in embedded measures. However, even should this occur the geographic extent of any effect would be highly localised due to the dilution effect when working in offshore areas.

*the potential effects of pollution have been discounted for all ornithological features based on the pollution control measures described in Section XX

Commented [A43]: Placeholder: Reference to be added in final checks

14.6 Characteristics of the Development

Due to the wide-ranging nature of this impact assessment, specific project details have not been brought across from the project description; instead, the detail within Volume 4 Environmental Report for UK Offshore – Chapter 5: Project Description should be referred to, to inform this assessment.

14.7 Likely Significant Impacts of the Development

14.7.1 Assessment of Effects – Benthic Habitats and Ecology

Installation phase

Release of hazardous substances through loss of chemicals / fuels from installation vessels

During all works at sea, there is the potential for loss of chemicals, fuels, or other pollutants as a result of accidental spills from installation vessels and other associated heavy plant. This can result in both direct toxic effects on individuals in the water column and on the seabed, and subsequent effects on other species in the food-web, including predator species such as seabirds and marine mammals.

To minimize risks of pollution incidents international best practice will be followed, for example adherence to the MARPOL Convention, the main convention covering pollution prevention in the marine environment, including from operational or accidental causes. Further, Project-specific requirements and procedures will be outlined in the Installation Environmental Management Plan (CEMP) and Project Prevention Plan (PPP).

Depending on the severity of any pollution incidents, the magnitude of change could be High. However, through the use of preventative measures and various control plans in place, the risk of occurrence of such incidents is Low and the magnitude of impact assessed as Low. Coupled with the high capacity of the marine environment for dilution of pollutants, the magnitude of the effect is assessed as Low and Not Significant.

Changes in water quality through release of contaminants held within the marine and coastal sediments

Through the installation of the cable route, the disturbance of sediment is inevitable. Depending on the quality of that sediment, there is the subsequent potential for contaminants to be released into the marine environment. This could potentially cause both direct and indirect effects on benthic habitats, and the communities associated with them, as well as through consumption up the food chain to larger predators. Detailed analysis and assessment of marine sediment quality along the cable route is presented in Volume 4 Environmental Report for UK Offshore – Chapter 11: Marine Sediment Quality. Consideration of how water quality may be affected by the project disturbing marine sediment is outlined in Volume 4 Environmental Report for UK Offshore - Chapter 13: Marine Water Quality. At a high level, data collected along the cable route found that the dominant seabed sediment type present was gravelly muddy sand. From a contaminants perspective, there were low levels of hydrocarbons and trace metals present in the sediment samples, with the majority recorded at below Cefas Action Level 1, and Canadian Sediment Quality Guidelines threshold effect levels (TEL), standard guidelines for sediment quality. Slightly higher levels, above guideline levels, were recorded for some contaminants, including lead and arsenic. However, overall, the concentrations of heavy and trace metals were found to be **Low** and consistent along the survey corridor, suggesting little anthropogenic contamination in the area. The cable route does not pass through any habitats or areas of environmental sensitivity, which means the cable route exhibits low sensitivity. The presence of any contaminated sediment within the water column will be temporary, with material subsumed into natural sediment transport processes. The magnitude of the effects on water quality due to release of contaminated sediments during installation are therefore considered to be **Low** and **Not Significant**.

Disturbance to, and loss of / change to, benthic habitats during cable installation (including through smothering)

During installation of the Celtic Interconnector, disturbance of the seabed and associated loss of habitats will be unavoidable. As presented in Volume 4 Environmental Report for UK Offshore Chapter 12 – Marine Physical Processes, the assumption has been made that direct disturbance to the seabed will be limited to the immediate cable route, with an overall corridor of 15m. In addition to this, there is the potential for indirect effects over a wider area, including through increased levels of suspended sediment concentration (SSC) in the vicinity of the Project. Although the distance and duration that this material remains in the water column depends on a number of factors, including the particle size and water movement, the geographic extent of increase SSC is not expected to extend more than 10km from the cable route (BERR, 2008), with the majority of material resettling within 1km, and within a few hours of disturbance. Additional evidence (Aquind, 2019) supports this, noting that smothering of habitats did not extend beyond 1km from the cable route.

Depending on the installation method used, the trench created for the cable's installation may be partly back-filled by the cable-laying equipment. However, some temporary disturbance to the local sediments is likely to remain once the cable is installed. As a worst case it is therefore assumed that all habitat will be permanently changed or lost under the footprint of the cable route and within the 15m wide corridor. Within the UK EEZ, with a cable length of 211km, this would result in a worst-case direct habitat loss of 3.165km^2. Given the overall area of similar habitat type within the wider marine area of the UK EEZ, this is assessed as a Low magnitude impact.

As described above, the cable route does not pass through any environmentally-sensitive habitats or features. For the majority of the route the habitats can be considered of Low value/importance, with the seabed comprising mobile sediments, including fine and coarse-grained sand, with features including mobile sand ripples and waves. Based on these existing conditions, it is anticipated that trenches will be filled gradually following installation through a combination of mechanical infill as the cable installation equipment progresses, and natural marine processes, with the seabed being restored to pre-installation conditions shortly after installation. As a result, effects arising from direct disturbance to benthic habitats are considered to be of Low magnitude and Not Significant. Further, through the selection of appropriate installation methods, indirect effects on benthic habitats as a result of increased suspended sediment levels are also considered to be Not Significant.

Although colonization rates of sedimentary environments can vary widely, depending on the biodiversity of the adjacent areas, and the duration of disturbance, individuals can begin to move back into a previously disturbed area immediately once the works have finished. Further, as presented in Figure X-X, the works area is surrounded by what will remain undisturbed sediment, meaning existing biodiversity is immediately present to recolonize over time. With no habitats of key environmental sensitivity, and considering the temporary nature of the works, effects as a result of installation are considered to be of Low magnitude and Not Significant.

Disturbance to, and loss of / change to, benthic habitats during installation of external cable protection

Following installation of the cable itself, along certain sections of the cable route, there may be the need for the installation of external cable protection, comprising either rock placement, or mattressing. This may occur in either sedimentary, or hard substrate seabed conditions, depending on whether the requirement for external protection is based on ground conditions being unsuitable for cable burial, or where a cable-crossing needs to be undertaken. In the UK EEZ, it has been estimated that up to 80km of cable length will require installation of external cable protection, affecting a maximum area of up to 1.2km^2.

Where cable protection is required, it has been assumed that this will be installed immediately, or shortly after, cable installation. Therefore, habitats initially disturbed by cable-laying equipment, and the installation of the cable itself, will not yet have had chance to recover from that initial disturbance. Installation of external cable protection is therefore not expected to have further effects on these habitats, and effects are considered to be of Low magnitude and Not Significant.

In addition to the above, there is potential for external rock protection to provide a degree of habitat creation in the marine environment. Rock placement, or installation of mattressing, may provide hard substrate on which species may settle out and colonise.

Operational phase

Following installation of the cable, and external cable protection as required, further effects on intertidal and subtidal communities are not anticipated during the operational phase.

Decommissioning phase

[PLACEHOLDER]

Commented [A44]: Placeholder: Standard decommissioning text to be agreed, and inserted prior to submission of final Application File.

14.7.2 Assessment of Effects - Marine Mammals

Installation phase

Underwater noise and disturbance to marine mammals

Underwater noise and disturbance effects on marine mammals in the subtidal zone (all groups) are possible during the installation phase. This is particularly so, as a result of underwater noise from subsea survey and monitoring equipment (potentially causing behavioural responses, masking, auditory injury and non-auditory injury) and increased vessel movements (potentially causing collisions and physical injury/mortality).

For underwater noise from the subsea survey and monitoring equipment (potentially causing behavioural disturbance, auditory injury and non-auditory injury) this is a Negative, Short-term, Permanent impact, which is Probable to occur for receptors of European ecological value. This is considered to be a Low magnitude impact (due to the small-scale reduction, within range of natural variability, and not being expected to result in any permanent change) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation, this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

For increased vessel movements (causing collisions and physical injury/mortality) this is a Negative, Short-term, Permanent impact, which is Unlikely to occur for a receptor of European ecological value. This is considered to be a Very Low magnitude impact (some effects on individuals, size of population means little or no change, within natural variability, no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

Operational phase

Underwater noise and disturbance to marine mammals

Underwater noise and disturbance effects on marine mammals in the subtidal zone (all groups) are possible during the operational phase. This is particularly so, as a result of underwater noise from subsea survey and monitoring equipment (potentially causing behavioural responses, masking, auditory injury and non-auditory injury) and increased vessel movements (potentially causing collisions and physical injury/mortality).

For underwater noise from the subsea survey and monitoring equipment (potentially causing behavioural disturbance, auditory injury, and non-auditory injury) this is a Negative, Medium-term, Permanent impact, which is Probable to occur for receptors of European ecological value. This is considered to be a Low magnitude impact (small-scale reduction, within range of natural variability, not expected to result in any permanent change) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

For increased vessel movements (causing collisions and physical injury/mortality) this is a Negative, Medium-term, Permanent impact, which is Unlikely to occur for a receptor of European ecological value. This is considered to be a Very Low magnitude impact (some effects on individuals, size of population means little or no change, within natural variability, no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

Decommissioning phase

Underwater noise and disturbance to marine mammals

Underwater noise and disturbance effects on marine mammals in the subtidal zone (all groups) are possible during the decommissioning phase. Particularly, as a result of underwater noise from subsea survey and monitoring equipment (potentially causing behavioural responses, masking, auditory injury and non-auditory injury) and increased vessel movements (potentially causing collisions and physical injury/mortality).

For underwater noise from the subsea survey and monitoring equipment (potentially causing behavioural disturbance, auditory injury, and non-auditory injury) this is a Negative, Short-term, Permanent impact, which is Probable to occur for receptors of European ecological value. This is considered to be a Low magnitude impact (small-scale reduction, within range of natural variability, not expected to result in any permanent change) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

For increased vessel movements (causing collisions and physical injury/mortality) this is a Negative, Short-term, Permanent impact, which is Unlikely to occur for a receptor of European ecological value. This is considered to be a Very Low magnitude impact (some effects on individuals, size of population means little or no change, within natural variability, no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

14.7.3 Assessment of Effects - Marine Turtles

Installation phase

Underwater noise and disturbance to marine turtles

Underwater noise and disturbance effects on marine turtles are possible during the installation phase. Particularly, as a result of increased presence of support and install vessels, cable laying with trenching and install of external cable, subsea survey and monitoring equipment (potentially causing behavioural disturbances, low frequency masking, vessel collisions, auditory injury and non-auditory injury).

For underwater noise from increased presence of support and installation vessels (potentially causing behavioural disturbances, low frequency masking and vessel collisions) this is a Negative, Short-term, Temporary and Permanent impact, which is Unlikely to occur for a receptor of European ecological value. This is considered to be a Very Low magnitude impact (some effects on individuals, size of population means little or no change, within natural variability, no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of the receptor, which is of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

For underwater noise from cable laying with trenching and install of external cable (potentially causing behavioural disturbances, low frequency masking and vessel collisions) this is a Negative, Short-term, Temporary and Permanent impact, which is Unlikely to occur for a receptor of European ecological value. This is considered to be a Very Low magnitude impact (some effects on individuals, size of population means little or no change, within natural variability, no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

For underwater noise from subsea survey and monitoring equipment (potentially causing behavioural disturbances, low frequency masking, vessel collisions, auditory injury and non-auditory injury) this is a Negative, Short-term, Temporary and Permanent impact, which is Unlikely to occur for a receptor of European ecological value. This is considered to be a Very Low magnitude impact (some effects on individuals, size of population means little or no change, within natural variability, no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

Operational phase

Underwater noise and disturbance to marine turtles

Underwater noise and disturbance effects on marine turtles are possible during the operational phase. Particularly, as a result of subsea survey and monitoring equipment (potentially causing behavioural disturbances, low frequency masking, vessel collisions, auditory injury and non-auditory injury).

For underwater noise from subsea survey and monitoring equipment (potentially causing behavioural disturbances, low frequency masking, vessel collisions, auditory injury and non-auditory injury) this is a Negative, Medium-term, Temporary and Permanent impact, which is Unlikely to occur for a receptor of European ecological value. This is considered to be a Very Low magnitude impact (although there may be some effects on individuals, the size of population means little or no change overall, within natural variability, and no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

Decommissioning phase

Underwater noise and disturbance to marine turtles

Underwater noise and disturbance effects on marine turtles are possible during the decommissioning phase. Particularly, as a result of subsea survey and monitoring equipment (potentially causing behavioural disturbances, low frequency masking, vessel collisions, auditory injury and non-auditory injury).

For underwater noise from subsea survey and monitoring equipment (potentially causing behavioural disturbances, low frequency masking, vessel collisions, auditory injury and non-auditory injury) this is a Negative, Short-term, Temporary and Permanent impact, which is Unlikely to occur for a receptor of European ecological value. This is considered to be a Very Low magnitude impact (although there may be some effects on individuals, the size of population means little or no change overall, within natural variability, and no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

14.7.4 Assessment of Effects – Basking Shark

Installation phase

Underwater noise and disturbance to basking shark

Underwater noise and disturbance effects on basking shark are possible during the installation, phase. Particularly, as a result of increased presence of support and installation vessels, cable laying with trenching and install of external cable, subsea survey and monitoring equipment (potentially causing behavioural disturbances, low frequency masking, vessel collisions, auditory injury and non-auditory injury).

For underwater noise from increased presence of support and installation vessels (potentially causing behavioural disturbances, low frequency masking and vessel collisions) this is a Negative, Short-term, Temporary and Permanent impact, which is Very Unlikely to occur for a receptor of European ecological value. This is considered to be a Very Low magnitude impact (although there may be some effects on individuals, the size of population means little or no change overall, within natural variability, and no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of the receptor, which is of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

For underwater noise from cable laying with trenching and install of external cable (potentially causing behavioural disturbances, low frequency masking and vessel collisions) this is a Negative, Short-term, Temporary and Permanent impact, which is Very Unlikely to occur for a receptor of European ecological value. This is considered to be a Very Low magnitude impact (although there may be some effects on individuals, the size of population means little or no change overall, within natural variability, and no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

For underwater noise from the subsea survey and monitoring equipment (potentially causing behavioural disturbance, auditory injury and non-auditory injury) this is a Negative, Short-term, Permanent impact, which is Very Unlikely to occur for receptors of European ecological value. This is considered to be a Very Low magnitude impact (although there may be some effects on individuals, the size of population means little or no change overall, within natural variability, and no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

Operational phase

Underwater noise and disturbance to basking shark

Underwater noise and disturbance effects on basking shark are possible during the operational phase. Particularly, as a result of increased presence of support vessels, subsea survey and monitoring equipment (potentially causing behavioural disturbances, low frequency masking, vessel collisions, auditory injury and non-auditory injury).

For underwater noise from increased presence of support vessels (potentially causing behavioural disturbances, low frequency masking and vessel collisions) this is a Negative, Medium-term, Temporary and Permanent impact, which is Unlikely to occur for a receptor of European ecological value. This is considered to be a Very Low magnitude impact (although there may be some effects on individuals, the size of population means little or no change overall, within natural variability, and no short-term or long-term change to conservation status s) that requires mitigation so that impacts on the integrity of the receptor, which is of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

For underwater noise from the subsea survey and monitoring equipment (potentially causing behavioural disturbance, auditory injury and non-auditory injury) this is a Negative, Medium-term, Permanent impact, which is Unlikely to occur for receptors of European ecological value. This is considered to be a Very Low magnitude impact (although there may be some effects on individuals, the size of population means little or no change overall, within natural variability, and no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

Decommissioning phase

Underwater noise and disturbance to basking shark

Underwater noise and disturbance effects on basking shark are possible during the decommissioning phase. Particularly, as a result of increased presence of support vessels, subsea survey and monitoring equipment (potentially causing behavioural disturbances, low frequency masking, vessel collisions, auditory injury and non-auditory injury).

For underwater noise from increased presence of support vessels (potentially causing behavioural disturbances, low frequency masking and vessel collisions) this is a Negative, Short-term, Temporary and Permanent impact, which is Very Unlikely to occur for a receptor of European ecological value. This is considered to be a Very Low magnitude impact (although there may be some effects on individuals, the size of population means little or no change overall, within natural variability, and no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of the receptor, which is of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

For underwater noise from the subsea survey and monitoring equipment (potentially causing behavioural disturbance, auditory injury and non-auditory injury) this is a Negative, Short-term, Permanent impact, which is Very Unlikely to occur for receptors of European ecological value. This is considered to be a Very Low magnitude impact (although there may be some effects on individuals, the size of population means little or no change overall, within natural variability, and no short-term or long-term change to conservation status) that requires mitigation so that impacts on the integrity of these receptors, which are of National importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

14.7.5 Assessment of Effects – Fish Ecology

Installation phase

Disturbance to demersal and pelagic fish, their habitats, and grounds

During the installation phase, there is potential for disturbance to fish and their habitats in the subtidal zone. In Volume 4 Environmental Report for UK Offshore - Chapter 20: Commercial Fisheries this has been assessed as being a potential temporary loss in sediment areas (first 34km and last 57km of the route) and a permanent deformation in rock areas (120km of the route to the west of the Isles of Scilly). Particularly this would be as a result of seabed preparation/boulder clearance, cable burial and trenching operations (using a plough, mechanical trenching and specialist rock cutting tools) and potential rock protection or mattressing (potentially required to the south west of the Isles of Scilly).

For seabed preparation/boulder clearance and burial and trenching operations, the magnitude of potential impacts, is considered to be Negligible, with intermittent and temporary (less than one month) interference to fish and their habitats. Especially, as the burial and trenching operations will be advancing along the marine cable route at a rate of 1.5 km per day, and for a total of 139 days. Also, the footprint of the cable installation is only anticipated to be c.5-15m wide depending on the size of the equipment deployed and percentage overlap of the cable route with the adjacent ICES divisions is <1% for each division.

For potential rock protection or mattressing, the impact magnitude, is considered to be High, with permanent (greater than three years) interference to fish and their habitats.

The sensitivity, or importance, of this receptor has varied capacity to absorb change, fisheries interest and importance. The identified sediment areas are considered to be Medium, as their profile will be returned when the cable is buried/backfilled, they have moderate fisheries interest, with monk or angler fish, common sole, turbot, European hake and brill, all known to occupy muddy, sandy and mixed substrate areas. Also, these areas and target species within the Project area, are considered to be of Regional importance (referring to the 2018 and 2016 landings data, values and comparisons reported in Volume 4 Environmental Report for UK Offshore - Chapter 20: Commercial Fisheries). On this basis, and with design mitigation embedded, the impact significance has been assessed as Not Significant.

The identified rock areas are considered to be Medium, as their profile will be altered with potential rock protection or mattressing (even though these features provide structure and cover for some of target species), they have moderate fisheries interest, with European plaice, turbot, lemon sole, brill and pollack all occupying rocky, stony and mixed substrate areas. Also, these areas and target species within the Project area are considered to be of Regional importance (referring to the MMO 2018 and 2016 landings data, values and comparisons reported in Volume 4 Environmental Report for UK Offshore - Chapter 20: Commercial Fisheries). On this basis, and with design mitigation embedded, the impact significance has been assessed as Not Significant.

As identified in Sections 14.3.7 and 5 (Table 14.5), there is potential for disturbance to fish spawning and nursery grounds (with varying intensities and seasonality from the months of January to August inclusive). However, these grounds have largely been determined by presence of mobile adult fish (sometimes egg carrying or live-bearing), juvenile fish (densities), planktonic eggs and larvae (ichthyoplankton) within the water column and do not relate to direct impact on seabed habitat, therefore considered to be Not Significant in this context. Also, for any works that are carried out in between Sep and Dec, this assessment would be supported further.

Underwater noise and disturbance to demersal and pelagic fish

Underwater noise and disturbance effects on fish ecology in the subtidal zone are possible during the installation phase. Particularly, as a result of underwater noise from subsea survey and monitoring equipment (potentially causing behavioural responses, masking, auditory injury and non-auditory injury).

For underwater noise from the subsea survey and monitoring equipment (potentially causing behavioural disturbance, auditory injury and non-auditory injury) this is a Negative, Short-term, Permanent impact, which is Probable to occur for receptors of Regional ecological value. This is considered to be a Low magnitude impact (small-scale reduction, within range of natural variability, not expected to result in any permanent change) that requires mitigation so that impacts on the integrity of these receptors, which are of Local and Regional importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

Operational phase

Underwater noise and disturbance to demersal and pelagic fish

Underwater noise and disturbance effects on fish ecology in the subtidal zone are possible during the operational phase. Particularly, as a result of underwater noise from subsea survey and monitoring equipment (potentially causing behavioural responses, masking, auditory injury and non-auditory injury).

For underwater noise from the subsea survey and monitoring equipment (potentially causing behavioural disturbance, auditory injury and non-auditory injury) this is a Negative, Medium-term, Permanent impact, which is Probable to occur for receptors of Regional ecological value. This is considered to be a Low magnitude impact (small-scale reduction, within range of natural variability, not expected to result in any permanent change) that requires mitigation so that impacts on the integrity of these receptors, which are of Local and Regional importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

Decommissioning phase

Underwater noise and disturbance to demersal and pelagic fish

Underwater noise and disturbance effects on fish ecology in the subtidal zone are possible during the decommissioning phase. Particularly, as a result of underwater noise from subsea survey and monitoring equipment (potentially causing behavioural responses, masking, auditory injury and non-auditory injury).

For underwater noise from the subsea survey and monitoring equipment (potentially causing behavioural disturbance, auditory injury and non-auditory injury) this is a Negative, Short-term, Permanent impact, which is Probable to occur for receptors of Regional ecological value. This is considered to be a Low magnitude impact (small-scale reduction, within range of natural variability, not expected to result in any permanent change) that requires mitigation so that impacts on the integrity of these receptors, which are of Local and Regional importance, are avoided and/or controlled. With the embedded mitigation included this is considered to be an impact that is Not Significant in the context of the integrity of this ecological resource.

14.7.6 Cumulative Effects

As outlined in Section 4.8, consideration has been given as to whether any of the ecological features that have been taken forward for assessment in this chapter are likely to be subject to cumulative effects on ecological features because of the effects generated by other developments.

14.8 Summary of Mitigation Measures, Assessment and Monitoring

Commented [A45]: Placeholder: All mitigation measures are currently under review / discussion, and will be confirmed prior to submission of the final Application File

A range of environmental measures have been embedded into the development proposals as outlined in Section 14.4. Table 14.6 summarises the ecological features, changes and effects, embedded measures, and how these have influenced the assessment and requirements for ongoing surveillance and monitoring.

Table 14.6 Embedded Mitigation Measures, Assessment and Monitoring

Ecological Feature	Changes and Effects	Embedded Mitigation Measures and Influences (assessment, surveillance and monitoring)
Subtidal (benthic) Habitats and Species	Not Significant	• Project-related vessels will adhere to international best practise regarding pollution control, including the MARPOL convention; and • Use of appropriate installation equipment, determined by seabed type, will be used, to minimise seabed disturbance, subsequent release of sediment into the water column, and indirect effects on benthic habitats and species.
Marine Mammals (all groups) **Marine Turtles** **Basking Shark**	Not Significant	• Project-related vessels to be operated in line with IMO Guidelines for the reduction of underwater noise to address adverse impacts on marine life; • Operations will be undertaken in line with JNCC's 'Guidelines for minimising the risk of injury to marine mammals from geophysical surveys' (JNCC, 2017); • Use of technology and techniques that limit noise propagation (underwater).
Fish Ecology (key demersal and pelagic species)	Not Significant	• Project-related vessels to be operated in line with IMO Guidelines for the reduction of underwater noise to address adverse impacts on marine life;

Ecological Feature	Changes and Effects	Embedded Mitigation Measures and Influences (assessment, surveillance and monitoring)
Fish Ecology (key spawning and nursery species)	Not Significant	• Operations in the will include operational soft starts, so fish have the opportunity to move away from the sound source; • Use of technology and techniques that limit noise propagation (in air and underwater); • Project-related vessels will adhere to international best practise regarding pollution control, including the MARPOL convention; • Use of appropriate installation equipment, determined by seabed type, will be used, to minimise seabed disturbance, subsequent release of sediment into the water column, and indirect effects on fish; and • Use of appropriate burial depths (target 0.8-2.5m) and heat shielding during cable installation to reduce effects from heat emissions and electro-magnetic fields (EMF).

14.9 References

BERR (2008).

Commented [A46]: Placeholder: Reference details to be included

Botterell ZLR, Penrose R, Witt MJ, Godley BJ (2020) - Long-term insights into marine turtle sightings, strandings and captures around the UK and Ireland (1910– 2018). Journal of the Marine Biological Association of the United Kingdom.

Casper, B.M., Halvorsen, M.B. & Popper, A.N. (2012). Are Sharks Even Bothered by a Noisy Environment? In: Effects of Noise on Aquatic Life, Vol 730 (Ed. By A. N. Popper & A. Hawkins), pp. 93-997. Springer Link.

Casper, B.M. & Mann, D.A. (2009) – Field hearing measurements of the Atlantic sharpnose shark *Rhizoprionodon terraenovae.* Journal of fish biology, 75, 2768-76.

Casper, B.M. & Mann, D.A. (2006) – Evoked Potential Audiograms of the Nurse Shark (*Ginglymostoma cirratum*) and the Yellow Stingray (*Urobatis jamaicensis*). Environmental Biology of Fishes, 76, 101-108.

CIEEM (2018) - Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine".

Deaville et al. (2015) - UK Cetacean Strandings Investigation Programme. Annual Report for the period 1st January - 31st December 2015.

DEFRA (2017) - Risk assessment of seabird bycatch in UK Waters. Research project MB0126.

Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. (2012). Spawning and nursery grounds of selected fish species in UK waters. Sci. Ser. Tech. Rep., Cefas Lowestoft, 147: 56 pp.

European Seabirds at Sea (ESAS) - database maintained by the JNCC, also covering marine mammals) (https://jncc.gov.uk/our-work/monitoring-seabirds-at-sea/)

Froese, R. and D. Pauly. Editors. (2019). FishBase. World Wide Web electronic publication. www.fishbase.org, (12/2019).

Hammond et al (2017) - Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys;

Hastings, M.C. and J. Miskis-Olds (2011) - Shipboard assessment of hearing sensitivity of tropical fishes immediately after exposure to seismic air gun emissions at Scott reef. In: Popper, A.N. and A. Hawkins, eds. Effects of noise on aquatic life. New York: Springer Science and Business Media, LLC.

ICES (1992) Effects of extraction of marine sediments on fisheries. ICES Cooperative Research Report No. 182. International Council for the Exploration of the Sea, Copenhagen.

ICES - eco system data portal (https://ecosystemdata.ices.dk/);

JNCC (2017) - JNCC's 'Guidelines for minimising the risk of injury to marine mammals from geophysical surveys'.

JNCC (2015) - JNCC Report No. 547: Management units for cetaceans in UK waters. Available online at: https://data.jncc.gov.uk/data/f07fe770-e9a3-418d-af2c-44002a3f2872/JNCC-Report-547-FINAL-WEB.pdf

JNCC Species account: Grey seal: https://sac.jncc.gov.uk/species/S1364/. [Accessed 20 February 2021].

JNCC Species account: Common seal: https://sac.jncc.gov.uk/species/S1365/. [Accessed 20 February 2021].

Lavender, A.L., S.M. Bartol, and I.K. Bartol. (2010) – Hearing capabilities of loggerhead sea turtles (*Caretta caretta*) throughout ontogeny. Proceedings of the Second International Conference on the Effects of Noise on Aquatic Life, Cork, Ireland.

Lavender, A. L., S.M. Bartol, and I.K. Bartol. (2011) – A two-method approach for investigating the hearing capabilities of loggerhead sea turtles (*Caretta caretta*). Proceedings of 31st Annual Symposium on Sea Turtle Biology and Conservation, San Diego, C.A.

MMO (2012-2018a) - United Kingdom commercial sea fisheries landings by Exclusive Economic Zone of capture: 2012-2018.

MMO (2012-2018b) - Landings data by Exclusive Economic Zone for all UK registered vessels 2016 and 2012-2018.

MMO (2016) - UK Sea Fisheries Statistics 2016.

NBN Atlas - species database (https://species.nbnatlas.org).

Reid, J B, Evans, P G H, and Northridge, S P (2003) - Atlas of Cetacean distribution in north-west European waters. Joint Nature Conservation Committee, Peterborough.

Russell and McConnell (2014) - Seal at-sea distribution, movements and behaviour. Report to DECC. URN:14D/085 March 2014 (final version). Sea Mammal Research Unit, University of St Andrews.

Sea Mammal Research Unit (SMRU) (2011) - Special Committee on Seals (SCOS) Scientific advice on matters related to the management of seal populations: 2011. Available online at: http://www.smru.st-andrews.ac.uk/files/2016/08/SCOS-2011.pdf.

Thompson et al. (1996) - Comparative distribution, movements and diet of harbour and grey seals from Moray Firth, NE Scotland. Journal of Applied Ecology, 33(6):1572-1584.

The Irish Sea Leatherback Turtle Project (2006) Final Project Report. Available online at: https://www.swansea.ac.uk/bs/turtle/reprints/INTERREG%20IIIA%20Irish%20Sea%20Leatherback%20Turtle%20Project%20-%20Final%20Report.pdf. [Accessed 23 January 2021]

MARPOL Convention - https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx (Accessed 24 November 2020).

Myrberg, A.A. (2001) – The acoustical biology of elasmobranchs. 31-45.

Nedwell, J.R., B. Edwards, A.W.H. Turnpenny, and J. Gordon (2004). Fish and marine mammal audiograms. A summary of available information. Prepared by Subacoustech Ltd, Hampshire, UK. Report 534 R 0214.

Nedwell, J. R. and D. Howell (2004) – A review of offshore windfarm related underwater noise sources. COWRI report No. 544 R 0308, 57 pp..

Popper, A.N. and M. C. Hastings (2009) – The effects on fish of human-generate (anthropogenic) sound. Integrative Zool. 4:43-52.

Popper, A.N., M.B. Halvorsen, E. Kane, D.D. Miller, M.E. Smith, P. Stein, and L.E. Wysocki (2007). The effects of high-intensity, low frequency active sonar on rainbow trout. *Journal of the Acoustical Society of America* 122:623-635.

Witt et al (2012) - Basking sharks in the northeast Atlantic: spatio-temporal trends from sightings in UK waters.

Woodward et al 2019.

15 Seascape and Landscape

15.1 Introduction

An assessment on changes to seascape character as a consequence of the cable protection installation (including associated vessel movements) associated with the Celtic Interconnector Project and the long-term presence of the cable protection in the marine environment has been scoped out of the Environmental Report (ER).

15.2 Seascape character

The Seascape Character Assessment for the South West Inshore and Offshore marine plan areas identifies that the UK EEZ length of cable route passes through two Marine Character Areas (MCAs). These are:

- MCA 51: Bristol Channel Approaches; and
- MCA 52: Western English Channel Approaches.

The overall character of MCA 51: Bristol Channel Approaches is described in the extant Seascape Character Assessment as having:

"*A rich natural environment and important heritage. The deep offshore waters extend to Haig Fras, a submerged rock outcrop which locally reduces bathymetry to only 38m from 100m. This is one of several designated or proposed areas for MCZ due to their nationally and internationally important sediment habitats. Forming part of the Celtic Sea, the MCA has important historical connections with the Celtic nations of Wales and Ireland which are still apparent today with ferries, pleasure craft and submarine communication cables crossing from England to Ireland. Shipwrecks on the seafloor indicate the areas strategic positioning during periods of conflict, more recently during WWII.*"

MCA 52: Western Channel Approaches borders French waters to the south and covers a large area of open water. The Seascape Character Assessment for the South West Inshore and Offshore marine plan areas describes the overall character as follows:

"*Below the surface, a gradually shelving seafloor consistent of distinct geological bands is covered by mobile sediment layers which migrate to form crescent-shaped submerged dune systems. Seafloor features combine with aquatic thermal fronts to create a unique and rich marine environment; making this one of the most diverse habitats for fish, cetaceans and sea birds in the UK. The area has a long maritime heritage associated trade and military use which continues today – with much of the area used as a submarine training area and crossed by ferries or fishing vessels. Sea conditions can be difficult with strong prevailing winds regularly reaching gale force, creating high waves. Away from the main shipping channels, feelings of isolation and exposure are strong.*"

15.3 Likely Significant Impacts of the Development

An assessment on seascape character as a consequence of the cable protection installation (including associated vessel movements) and the long-term presence of the cable protection in the marine environment has been scoped out of the ER. The technical note submitted to the MMO in

January 2021 Technical Note: Proposed scope and content of the UK Marine Licence Application and supporting Environment Report and Assessments (Wood, 2021) identified two potential impacts as set out in Table 15.1 below. Neither of these were considered to be significant.

Commented [A47]: MMO's view on the decision to scope this out of the ER is awaited.

Table 15.2 Seascape– Likely Significant Impacts of the Development scoped out of the assessment

Potential impact	Rationale	Potential mitigation
Changes to seascape character within the UK EEZ during the installation of the cable protection.	Changes to seascape character within MCAs 51 and 52 within the UK EEZ will be associated with the presence of vessels installing the cable protection on the seabed. The temporary presence of vessels is not an uncommon characteristic of the baseline seascape character (as noted in the baseline descriptions of the overall character) and cable protection would be introduced within a narrow corridor and along localised sections only. As a consequence, significant effects upon the key characteristics and character of MCA 51 and 52 are unlikely to occur.	Not applicable
Changes to seascape character within the UK EEZ during the operational phase	There would be very limited above surface changes to seascape character during the operational phase with the presence of any operational maintenance or survey vessels representing an occasional occurrence which is in keeping with the existing seascape character. The long-term presence of cable protection on the seabed would continue within a narrow and localised corridor hence significant effects upon the key characteristics and character of MCA 51 and 52 are unlikely to occur.	Not applicable

15.4 References

Commented [A48]: References to be added

16 Archaeology and Cultural Heritage

16.1 Introduction

This chapter of the ER assesses the likely significant effects of the Proposed Development with respect to the marine historic environment within the United Kingdom Exclusive Economic Zone (UK EEZ). This chapter should be read in conjunction with the development description provided in Volume 4 Environmental Report for UK Offshore – Chapter 5: Project Description.

The Marine Policy Statement sets out that the historic environment includes all aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged.

In this case, potential receptors of effects arising from the proposed development fall into two categories; archaeological remains, primarily remains of vessels lost at sea or other marine wreckage, and deposits of archaeological interest, comprising sediments of potentially terrestrial origin that have been inundated by rising sea levels.

16.2 Methodology and Limitations

16.2.1 Legislation and Guidance

This ER is concerned with the effects arising on the marine historic environment within the UK EEZ. Consequently, the relevant legislative framework is set by:

- The Protection of Wrecks Act 1973 which provides for the legal designation and protection of wreck sites on grounds of historical, archaeological or artistic value (Section 1) or danger to navigation (Section 2);
- The Ancient Monuments and Archaeological Areas Act 1979 which applies only to UK Territorial Waters and is therefore not applicable to the present project;
- The protection of Military Remains Act 1986 which provides statutory designation and protection of wreckage of aircraft or vessels lost in military service. This act has been modified by numerous statutory instruments identifying wrecks of vessels designated under the act, the latest being The Protection of Military Remains Act 1986 (Designation of Vessels and Controlled Sites) Order 2017, which identifies 79 wrecks as protected places and 12 wreck sites as controlled areas; and
- The Marine and Coastal Access Act 2009 which established the statutory basis for marine spatial planning within the UK Marine Area and set up a regime of regional marine plans.

The Marine Policy Statement sets out a process for the treatment of the historic environment in the marine planning process. A significance-based approach to assessment is set out, in which the interest in heritage assets and the value they hold for this and future generations should be understood and used to develop proposals for the conservation of that interest.

The Draft South West Marine Plan notes the area of the UK EEZ through which the proposed development passes as Marine Plan Area 9 – South West Offshore, and sets out the importance of the cultural heritage of the region in its vision statement, although no specific policies on cultural heritage are set out.

Historic England guidance on the treatment of the historic environment in marine planning is set out in:

- Good Practice Advice in Planning Note 2 (GPA 2): Managing Significance in decision-taking in the Historic Environment (2015);
- Conservation Principles, Policies and Guidance (2008);
- Conservation Principles for the Sustainable Management of the Historic Environment - consultation draft (2017);
- Deposit Modelling and Archaeology (2020);
- Environmental Archaeology (2011);
- Geoarchaeology (2011);
- Historic Environment Guidance Note for the Offshore Renewable Energy Sector (2007);
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (2011);
- Marine Geophysics Data Acquisition, Processing and Interpretation (2013);
- Guidance for the Assessment of Cumulative Impacts on the Historic Environment from offshore Renewable Energy (2008);
- Code of Practice for Seabed Developers (2006); and
- People and the Sea: A Maritime Archaeological Research Agenda for England (2013).

International Guidance and policy on the treatment of the marine historic environment is also set out in:

- European Convention on the Protection of the Archaeological Heritage (The Valetta Convention) 1992;
- UNESCO Convention on the Protection of the Underwater Cultural Heritage (2001);
- International Council of Monuments and Sites (ICOMOS) Charter on the Protection and Management of Underwater Cultural Heritage (1996) (the Sofia Charter); and
- United Nations Convention on the Law of the Sea (UNCLOS) 1982.

EirGrid have published guidance on Cultural Heritage, *Guidelines for Electricity Transmission Projects: A Standard Approach to Archaeological, Architectural and Cultural Heritage Impact Assessment of High Voltage Transmission Projects* (2015)[11]. While this primarily relates to Irish terrestrial archaeology, it sets out EirGrid's use of a staged process to ensure that archaeology and cultural heritage issues at considered at each stage of the development process.

[11] EirGrid (2015) *Cultural Heritage Guidelines for Electricity Transmission Projects A Standard Approach to Archaeological, Architectural and Cultural Heritage Impact Assessment of High Voltage Transmission Projects (2015).*

16.3 Desktop Studies

16.3.1 Supporting Baseline Surveys

Archaeological assessments of the entire route were undertaken by Headland Archaeology (2014[12]; 2015[13]) including a desk-based assessment (DBA), and assessment of marine geophysical survey data for the entire route and two landfall location options in Ireland. A geoarchaeological assessment of vibrocore logs was also conducted (Wessex Archaeology 2016)[14]. These surveys cover the majority of the application route, although there are some variations introduced during design which moved the final route within the Wider Study Area slightly further to the south-west of the Isles of Scilly.

Cotswold Archaeology was commissioned 2019 to undertake further archaeological assessments on the new / revised routes; within the UK EEZ, this report drew on the baseline presented in the 2014 reporting.

Marine geophysical surveys of the final cable route were undertaken by Osiris in 2016; potential wrecks and wreckage identified in these surveys is referenced in the baseline reporting.

Desk-based studies which have informed the development of the scope and baseline of this assessment are set out at Table 16.1.

Table 16.1 Desk-based studies

Study	Scope and Key Findings	Appended as
Ireland-France Celtic Interconnector, Marine archaeology desk-based assessment. (Headland Archaeology 2014)	Marine Archaeology baseline study aiming to: • Assess the nature of the cultural resource in this area; • To outline the archaeological potential of the marine environment; • To aid in the identification of seabed anomalies that may be discovered during the proposed; • geophysical survey; and, • Inform and propose mitigation for sites that may be impacted by the proposed geotechnical survey. Results: • Identification of recorded potential wrecks and obstructions; and, • Identification of potential for survival of deposits of geoarchaeological interest within the intertidal and marine zones.	n/a
Celtic Interconnector Project, Marine	Consolidates previous reporting, focusing on the final agreed route. Sets out archaeological	Appendix 16A

Commented [A49]: Appendices to be added.

[12] Headland Archaeology 2014 *Ireland-France Celtic Interconnector, Marine archaeology desk-based assessment.*
[13] Headland Archaeology 2015 *Ireland-France Celtic Interconnector: Archaeological Review of Geophysical Survey Data*

[14] Wessex Archaeology 2016 *Celtic Interconnector – Feasibility Study, Stage 1 Geoarchaeological Assessment of Vibrocore Logs.*

Study	Scope and Key Findings	Appended as
Archaeology and Cultural Heritage Report (Cotswold Archaeology 2019)[15]	baseline for the entire route between Irish and French landfalls, identifying areas of geoarchaeological and archaeological interest.	

16.3.2 Field Studies

Field studies that have influenced the scope and baseline of this assessment are set out at Table 16.2.

Table 16.2 Field studies

Study	Scope and Key Findings	Appended as
Celtic Interconnector – Feasibility Study, Stage 1 Geoarchaeological Assessment of Vibrocore Logs. (Wessex Archaeology 2016)[16]	Geoarchaeological assessment of vibrocore logs from Irish territorial waters and EEZ. Identified locations where deposits of geoarchaeological interest survive	Appendix 16B

Commented [A50]: Appendix to be added

16.3.3 Methodology for Assessment of Effects

Effect Categorisation

The likely effects anticipated to arise on the marine historic environment are, in this case, considered to be primarily direct effects in that disturbance of archaeological remains and deposits of geoarchaeological interest would arise only through direct disturbance caused by site clearance, cabling or cable protection operations. Given the depth of the seabed in the Cable Study Corridor (SCS), the proposed development is not anticipated to give rise to change to processes such as scour or accretion that are likely to give rise to indirect disturbance of archaeological remains or deposits (see Volume 4 Environmental Report for UK Offshore - Chapter 12: Marine physical processes).

The deposit sequences of geoarchaeological interest are present over an extensive area, and could potentially be affected by other developments, which presents a potential for cumulative effects. These deposits are present primarily within the Irish EEZ, although it is not considered that a transboundary effect would arise as disturbance of these deposits in the Irish EEZ would be caused only by works carried out within the Irish EEZ, which are assessed in their own right in Volume 4 Environmental Report for UK Offshore - Chapter 16: Archaeology and Cultural Heritage.

Assignment of receptor value

Identified receptors have been assigned on the basis of professional judgement following guidance set out above to the following classes of value as set out at Table 16.3.

[15] Cotswold Archaeology 2017 *Celtic Interconnector Project Marine archaeology desk-based assessment*
[16] Cotswold Archaeology 2019 *Celtic Interconnector Project, Marine Archaeology and Cultural Heritage Report.*

Table 16.3 Receptor value

Value	Rationale
High	Features of high value are typically those of international/national importance recognised by designation (e.g. World Heritage Sites, Scheduled Monuments and designated wrecks). High value features may also include those which are not at present designated, but which hold equivalent significance and/or appear likely to meet any relevant criteria for designation
Medium	Features of medium value are not normally designated but have value on a regional level. These features typically hold evidential or historical value on a regional level as relatively complete or well-preserved examples of common feature types or represent less well-preserved elements of more unusual features
Low	Features of low value would not be designated and would generally represent less well-preserved examples of common features of which more representative and better-preserved examples exist, or which hold value on a local level
Negligible	Features of negligible value are typically very poorly preserved and have little or no value, but may be worthy of note

Magnitude of Effect

Magnitude of effect has been classified by professional judgement into the classes of magnitude that are described in Table 16.4 and Table 16.5.

Table 16.4 Magnitude of Change

Value	Rationale – Adverse	Rationale - Positive
High	Total or near total loss of significance of an archaeological site or feature	Removal of urgent risks to a site or feature and provision of significant enhancements to management, understanding and access/interpretation
Medium	Disturbance of key elements of an archaeological site or feature, leaving the feature legible but discernibly disturbed	Discernible enhancements to a site or feature, for example preventing a gradual declining trend in preservation, or enhancing public understanding
Low	Minor disturbance of minor elements of an archaeological site or feature, leaving any remains or deposits largely legible or otherwise undamaged	Minor enhancements to management of a feature or site
Negligible	Very minor or superficial disturbance of a site or feature leaving all key elements readily legible	Very minor or superficial enhancements to a site or feature

Table 16.5 Significance matrix

Value	Magnitude			
	High	**Medium**	**Low**	**Very Low**

High	Profound	Significant-moderate	Moderate	Slight
Medium	Significant-moderate	Moderate	Slight	Not significant
Low	Moderate	Slight	Not significant	Not significant-imperceptible
Negligible	Slight-not significant	Not significant	Not significant-imperceptible	Imperceptible

Identification of Receptors

Potential receptors have been identified with reference to previous studies of the cable route verified by searches of records of known wrecks and obstructions within a 500m Cable Study Corridor (CSC), defined as an area 250m to either side of the proposed cable route, and a wider study area of 2.5km to either side of the proposed cable route, i.e. 5km width in total.

16.3.4 Difficulties Encountered

The marine geophysical survey and vibrocoring was carried out primarily for engineering purposes, and consequently the correlation of the archaeological deposit sequence with the subsea features is not ideal for predicting the survival of deposits of geoarchaeological interest or their distribution. This information is, however, sufficient to understand the value of these deposits, the nature and magnitude of any effect and the nature of proposed mitigation. Consequently, the evidence base for the ER is considered robust.

The evidence base for the presence of marine archaeological remains is generally predictive. Records of losses and study of geophysical surveys provide a comprehensive understanding of potential concerns and identify features that should be avoided by design, but mitigation proposals have been developed to ensure that any limitations to these surveys can be adequately mitigated.

16.4 Receiving Environment

Detailed baseline information is contained within the reports noted at Tables 16.1 and 16.2, and is not reproduced in full below. The following description of the baseline receiving environment identifies the key historic trends and process that bear on the baseline environment and sets out the relevant potential receptors of adverse effects.

16.4.1 Marine deposits of geoarchaeological interest

The Celtic Sea in its present state was formed after the end of the last glacial episode, with sea levels around 60-70 m below modern sea level at around 20,000 years before present (bp) rising to approximately modern sea level by around 3,500 years bp, although there is significant uncertainty over the detailed progress and chronology of that sea level rise. The rising sea levels covered former land surfaces; in most cases causing erosion which has removed those submerged land surfaces and exposed underlying bedrock, but in some cases leaving these former land surfaces in-situ and offering favourable conditions for the survival of organic remains. These are primarily of importance for providing information about the past environment at different periods, but which may also contain preserved remains of past human activity. These deposits have been identified surviving within the foreshore and near-shore environments as coherent and extensive deposit sequences, while within the marine zone, scour from rising sea levels has largely eroded these deposits such that they survive primarily in incised features such as former river valleys.

Specific areas of interest have been identified through marine geophysical survey and vibrocoring (Wessex Archaeology 2016). Sub-bottom profiling identified seven potential infilled channels, and geoarchaeological assessment of these sources identified four principal stratigraphic units:

- Unit 1 Bedrock: Chalk bedrock of no archaeological interest;
- Unit 2 Quaternary glacial/glacio-marine sediments: primarily Diamacton, sands, gravels and clays of the Caernarfon Bay Formation and Western Irish Sea Formation. These deposits hold limited archaeological interest, having a low potential to contain redeposited archaeological material and in some cases forming land surfaces on which Unit 3 deposits formed;
- Unit 3 Estuarine and terrestrial sediments: primarily laminae of peat in gravelly clay deposits. These deposits are of archaeological interest, with peat offering opportunities for preservation of organic remains which could inform understanding of past environments that pre-date inundation of the Celtic Sea area; and
- Unit 4 Seabed sediments: unconsolidated sands and gravels with frequent bivalve and gastropod shell surviving in various thicknesses up to 2.5m. These deposits have little or no archaeological interest.

The vibrocore locations where potentially archaeologically significant deposits were observed are primarily located within the Irish EEZ where they appear to represent discontinuous and isolated survivals of deposit sequences, although a single vibrocore within the UK EEZ appeared to represent part of the same group of deposit sequences. Following initial assessment, the single core from the UK EEZ has been identified as potentially suitable for further investigation.

Table 16.6 Vibrocore location where deposits of potential archaeological significance have been observed

ID	Depth From	Depth to	Rationale	Research Potential	Suitable for further investigation
VC-084	0.42	1.25	Slightly peaty slightly sandy clayey Silt	Palaeoenvironmental Interest Sea level minima reference points	Yes

These deposits are of particular significance as the first evidence for the survival of stratified deposit sequences relating to a pre-inundation archaeological landscape within the Celtic Sea area, and at depths of 96-104m below lowest astronomical tide are among the deepest marine peat deposits observed to date. While previous studies (e.g. Farr et al. 2017)[17] had suggested that

[17] Farr, R. H., Momber, G., Satchell, J. and Flemming, N. 2017 *'Paleolandscapes of the Celtic Sea and the Channel/La Manche' in Submerged Landscapes of the European Continental Shelf: Quaternary Paleoenvironments, First Edition. Ed. Flemming, N. C., Harff, J., Moura, D., Burgess, A. and Bailey, G. N. 2017 John Wiley & Sons Ltd.*

these deposit sequences might survive, recent research projects have not identified these deposits. These deposits have the potential to complement understanding of the past human occupation of the Celtic Sea region and the wider European continental shelf during the last glacial. They are certainly of national importance and have the potential to contribute to international research and understanding. These deposits are collectively considered as a receptor of high value.

16.4.2 Potential Archaeological Remains

The Celtic Sea is an area used in the historic period for access to the Atlantic ports of Ireland, England, Wales and France, and while recorded and potential wrecks and obstructions are more sparsely distributed, the potential that such features may be affected will remain. During the First World War, the Western Approaches were also a favoured operating location for German U-boats owing to the presence of multiple shipping routes in a relatively limited area of sea until the introduction of the convoy system and aerial patrols of the Western Approaches from 1917. This situation is reflected by the location of three wrecks of ships sunk by U-boats in 1915 in the CSC and WSA.

Initial studies by Headland Archaeology (Headland Archaeology 2014) identified a number of recorded losses within the CSC, and subsequent analysis of marine geophysical survey has identified further potential wrecks. Design iteration has pushed the proposed cable route slightly further to the west of the Scilly Isles, meaning that not all wrecks identified in the Headland Archaeology Report are represented here and that some wrecks not identified in that report are noted here. Where possible, tables 1.7 and 1.8 cross refer to the Headland Archaeology wreck identifiers. Marine geophysical survey was undertaken by Osiris, which identified a number of areas of potential wreckage and a possible wreck site

There are no formally designated wrecks within the CSC or wider study area, and a single recorded wreck is recorded within the CSC, although subsequent surveys have not identified this wreck. Recorded wrecks and obstructions and geophysical anomalies within the CSC are summarised at Table 16.7 and recorded losses and obstructions within the Wider Study Area (WSA) are summarised at Table 16.8.

Table 16.7 Recorded losses, obstructions and geophysical anomalies suggestive of potential wrecks within the CSC

ID	Name	Category	Lat	Long	Comments
21629	Gadsby	Non-dangerous wreck	49.4256667	-6.1348333	Recorded as dead wreck of British merchant vessel sunk by the submarine U-39, 33 miles SSW of Wolf Rock. There were no casualties (HA 1). Considered to be of high potential.
21689		Foul ground	49.5481347	-6.4544994	Identified as fisherman's fastener first recorded 1977 (HA 22). Considered to be of medium potential.
21646		Foul ground	49.4609236	-6.2253535	Identified as fisherman's fastener first recorded 1977 (HA 19).

ID	Name	Category	Lat	Long	Comments
					Considered to be of medium potential.
			Easting	**Northing**	
S176		Sonar anomaly	672053.90	5503708.40	Possible wreck identified in sidescan sonar survey; measures 7.7m x 4.2m x 1.9m. Considered to be of high potential.
M205		Magnetic anomaly	659168.20	5510438.70	Part of a cluster of anomalies possibly representing minor wreckage. Considered to be of low potential.
M206		Magnetic anomaly	659201.90	5510363.20	Part of a cluster of anomalies possibly representing minor wreckage. Considered to be of low potential.
M207		Magnetic anomaly	659242.20	5510264.90	Part of a cluster of anomalies possibly representing minor wreckage. Considered to be of low potential.
M208		Magnetic anomaly	659263.20	5510217.20	Part of a cluster of anomalies possibly representing minor wreckage. Considered to be of low potential.

Table 18.8 Recorded losses and obstructions within the WSA

ID	Name	Classification	Lat	Long	Comments
21723		Non-dangerous wreck	49.6031288	-6.4847754	Recorded as dead wreck of unknown vessel (HA 101)
21640	Nascent	Non-dangerous wreck	49.4506469	-6.2175763	Recorded as dead wreck of British merchant vessel sunk by submarine UC-49, 27 miles south of Bishop Rock. 6 persons were lost (HA 7)
21650	Nascent (possibly)	Non-dangerous wreck	49.4653679	-6.1945233	Recorded as alternate location of dead wreck of British merchant vessel sunk by submarine UC-49, 27 miles south of Bishop Rock. 6 persons were lost
21603		Non-dangerous wreck	49.3370333	-6.0111167	Live wreck found by echo-sounder first recorded in 1989 (HA 14)
21613		Foul ground	49.3945424	-6.1331389	Identified as fisherman's fastener first recorded in 1977 (HA 122)

ID	Name	Classification	Lat	Long	Comments
21648		Foul ground	49.4648125	-6.178136	Identified as fisherman's fastener first recorded in 1977 (HA 118)
21645		Foul ground	49.4589795	-6.2075774	Identified as fisherman's fastener first recorded in 1977 (HA 20 – also same coordinates cited for HA 116)
21652		Foul ground	49.4734216	-6.2950691	Identified as fisherman's fastener first recorded in 1977 (HA 124)
21918		Non-dangerous wreck	49.9525331	-6.95057	Live wreck found by echo-sounder first recorded in 1989
67069		Non-dangerous wreck	49.23425	-5.7873167	Recorded as live wreck found by found by multi-beam (HA 15)
16138		Foul ground	50.0355802	-6.9452946	Recorded as container found by found by echo-sounder (HA 111)
21936		Foul ground	49.5331364	-6.4311681	Recorded as found by echo-sounder first recorded in 1977 (HA 17)
21900		Non-dangerous wreck	49.5361924	-6.3589531	Noted as dead wreck shown on UKHO charts (HA 97)
21664		Non-dangerous wreck	49.4853056	-6.2261667	Live wreck found by echo-sounder first recorded in 1995 (HA 63)
21683		Foul ground	49.5359138	-6.4472776	Foul ground found by echo-sounder first recorded in 1989 (HA 110)
21999		Non-dangerous wreck	49.3582	-5.9872167	Foul ground found by echo-sounder first recorded in 1951 (HA 107)
21657		Foul ground	49.4795327	-6.2381304	Identified as fisherman's fastener first recorded 1977 (HA 115)
21978		Foul ground	49.205399	-5.7220639	Identified as fisherman's fastener first recorded 1977 (HA 21)
21776		Foul ground	49.6839517	-6.7141988	Identified as fisherman's fastener first recorded 1977 (HA 126)
21754	Indian City (possibly)	Non-dangerous wreck	49.6661768	-6.6019874	Recorded as possible wreck of British merchant vessel sunk by submarine U-29, 10 miles south of St Mary's, Scilly. There were no casualties. Found by echo-sounder in 1989 (HA 25)

ID	Name	Classification	Lat	Long	Comments
21801		Non-dangerous wreck	49.8156034	-6.8725193	Wreck of unknown vessel first recorded in 1969

The valuation of individual wrecks, obstructions and geophysical anomalies of archaeological potential is a matter for professional judgement based on an understanding of those remains. Wrecks which are substantially intact or undisturbed are generally likely to be of high value, though some particularly recent wrecks or debris resulting from chance loss of cargo of fishing gear may be considered to be of lower value. Similarly, wrecks which have previously been disturbed or which comprise less coherent scatters of wreckage are more likely to be of lower value. Where the exact nature and circumstances of a wreck are not known, a precautionary assessment of high value has been applied.

While UKHO records distinguish between ‘live’ (sites which can be identified) and ‘dead’ (recorded sites that cannot be or have not been identified in survey) wrecks, it is still possible that material deriving from a wreck is present and no necessary distinction can be made in terms of archaeological potential.

16.5 Characteristics of the Development

The proposed development requires the burial of the marine interconnector cable and the placement of cable protection.

Marine cabling would involve three stages:

- Preparation for cable laying:
  - Survey prior to work;
  - Clearance of obstacles;
  - Clearance of the sea floor along the corridor; and
  - Levelling of sand waves.
- Installation of marine cabling by:
  - Jetting;
  - Ploughing; and
  - Rock-cutting.
- Installation of cable protection.

Preparation and clearance of the proposed route has the potential to give rise to disturbance of archaeological material on the seabed, while cable installation would primarily affect material buried under marine sediments. Given the extent of preparation required in advance of cabling and disturbance arising from cabling, it is not considered that placement of cable protection would give rise to disturbance of archaeological remains.

16.6 Likely Significant Impacts of the Development

16.6.1 Do Nothing

In the Do Nothing scenario, no significant change is anticipated to the baseline.

Buried marine deposits of geoarchaeological interest are similarly unlikely to experience significant change, although depth of cover by what appear to be relatively mobile marine sediments and potential erosion may present very minor change to the observed baseline.

Similarly, any wrecks present within the CSC would be subject to continuing natural decay resulting from the natural degradation of construction materials and the action of sedimentation and erosion. Again, these processes would be very gradual and unlikely to present discernible change in the baseline in the duration of the project lifespan.

16.6.2 Construction Phase

Cable laying

Offshore deposits of geoarchaeological interest would be directly disturbed during the insertion of the marine cable where the cable is installed by jetting or ploughing. These deposits are not present in areas where rock-cutting would be used.

The anticipated depth of burial of the cable would be sufficient to remove or disturb deposits of geoarchaeological interest in all areas of the cable route where these remains have been observed to survive. However, these deposits also appear to be relatively extensive features and potential disturbance would be limited to small areas of these wider deposit sequences. Consequently, in the absence of any mitigation this direct effect on a receptor of high value is assessed as of low magnitude, which would result in a moderate adverse effect. Mitigation measures have therefore been considered in section 16.7

The route of the proposed cabling has been designed to avoid disturbance of known or potential wreck sites, although some areas of ferrous debris have been identified within the route corridor (anomalies M205-208 and M1348-1349). These areas do not correspond to known wrecks and have magnetic signatures that are suggestive of scattered wreckage rather than a coherent or intact wreck site. It is therefore considered that these anomalies represent archaeological remains of low significance

In that marine geophysics has been undertaken, and areas of potential archaeological interest have been identified, there is a low potential that remains of further previously unrecorded wrecks or other archaeological material may be present within the working area. Consequently, it is not anticipated that any necessary disturbance of such remains would occur, either during cabling or installation of cable protection, but there is a limited potential for inadvertent disturbance of remains that have not yet been identified during installation of cabling and installation of cable protection.

Whilst it is not anticipated that any significant adverse effect would arise, mitigation measures have been set out to minimize the potential for disturbance and to ensure that statutory requirements to avoid disturbance of wrecks can be met.

Cable protection

No adverse effects are anticipated as a result of installation of cable protection in that any disturbance would have arisen during the installation of cabling.

16.6.3 Operational Phase

Cable

No adverse effects are anticipated as a result of the operation of the proposed cable.

Cable protection

Adverse effects would only arise during the operational phase of the proposed development where the installed cable protection altered local marine and coastal processes to induce or accelerate scour or differential deposition of marine sediments, affecting archaeological remains on the seabed. This would be anticipated in more dynamic environments, primarily in shallow water near shore where localised high points caused by construction of cable protection interact with tidal currents, and would be a relatively localised effect. It is not considered that any significant adverse effect would arise in the deeper waters through which the cable route passes in the UK EEZ.

16.6.4 Decommissioning Phase

A decommissioning plan will be prepared prior to the decommissioning phase of the proposed development, which is expected to be at least 40 years from the start of operation. It is currently anticipated that the cable and associated external cable protection will be left in-situ where this is deemed environmentally acceptable; this may require a level of long-term monitoring and maintenance. There are not expected to be any effects on archaeology and cultural heritage and sediments as a result of this proposed course of action. However, any works required for decommissioning will be subject to future consent applications, and environmental assessments, as relevant.

16.6.5 Cumulative Effects

As noted above, no adverse cumulative effects are anticipated to arise on archaeological remains and cumulative effects would be restricted to offshore deposits of geoarchaeological interest.

16.7 Mitigation and Monitoring Measures

Commented [A51]: Placeholder: All mitigation measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

16.7.1 Construction Phase

Offshore deposits of geoarchaeological interest

Mitigation of the disturbance of offshore deposits of geoarchaeological interest would be achieved by an agreed programme of further archaeological investigation and recordings, combined with analysis of archaeological material already recovered and appropriate publication/dissemination of the results.

- A suitably qualified and experienced Project Environmental Specialist will be appointed to develop a Project Environmental Remains Strategy in relation to the investigation and sampling of the offshore deposits of archaeological interest. This strategy will be prepared in accordance with English Heritage 2011 *Environmental Archaeology: a guide to the theory and practice of methods, from sampling and recovery to post-excavation* and Historic England 2015 *Geoarchaeology: using earth sciences to understand the archaeological record*.

- Where appropriate, this strategy will have regard to opportunities for archaeological analysis of material recovered during engineering site investigation in addition to any planned archaeological investigation.
- Due regard will be had in preparing any investigative methodology to the need to enable valid and robust comparison of results of analyses between samples recovered from the UK and Irish EEZ.

While the preparation of an archaeological record is not a complete mitigation of loss of informative value, this mitigation would discernibly reduce the potential effect of the scheme and would provide information that would provide a clearer understanding of the importance of the archaeological resource informing its management in the future. Consequently, the magnitude of any change would be reduced to very low, resulting in a slight adverse effect.

Recorded and Potential Wrecks

Archaeological exclusion zones will be established round the sites of known and potential wrecks. These exclusion zones would be 100m from the recorded location or location of any high potential sites, and 50m from the location of any medium potential sites, and would be used to minimize the potential for inadvertent disturbance of wreck sites and to ensure their avoidance where the cable route is microsited. Measures setting out how initial pre-construction surveys aimed at investigating the potential presence of UXO and clearing potential obstructions would be used to ensure that clearance of the proposed route would not result in the disturbance of wreck sites and that archaeological material could be appropriately recorded and / or recovered are included within the draft archaeological Written Scheme of Investigation (WSI). Where these mitigation measures are in place, the worst-case magnitude of any change would be reduced to very low, a slight adverse effect. A Protocol for Archaeological Discoveries (PAD) is included within the WSI setting out actions to be carried out in respect of recovery of archaeological material.

Commented [A52]: The draft WSI remains under production and will be provided as part of the final application file.

16.7.2 Operational Phase

Mitigation of disturbance caused by potential scour would be achieved through the measures set out in the WSI for works during construction. Where an effect is anticipated and could not be avoided, this mitigation would reduce the magnitude of the effect to very low, a slight adverse effect.

16.8 Residual Impacts

Table 16.9 Summary of Residual Impacts

Receptor	Value	Effect	Magnitude pre-mitigation	Mitigation	Magnitude post-mitigation	Residual effect
Construction						
Offshore deposits of geoarchaeological interest	High	Disturbance of archaeologically significant deposits	Low	Agreed scheme of archaeological investigation	Very Low	Slight
Archaeological remains	High	Low potential for disturbance of wreck sites	High	Agreed scheme of archaeological investigation	Very Low	Slight-No Effect
Operation						
Offshore deposits of geoarchaeological interest	High	None anticipated	n/a	n/a	n/a	No Effect
Archaeological remains	High	None anticipated	n/a	n/a	n/a	No Effect
Decommissioning						
Offshore deposits of geoarchaeological interest	High	None anticipated	n/a	n/a	n/a	No Effect
Archaeological remains	High	None anticipated	n/a	n/a	n/a	No Effect

16.9 References

English Heritage (2007) Historic Environment Guidance Note for the Offshore Renewable Energy Sector

English Heritage (2008) Conservation Principles, Policies and Guidance

English Heritage (2008) Guidance for the Assessment of Cumulative Impacts on the Historic Environment from offshore Renewable Energy

English Heritage (2011) Environmental Archaeology

English Heritage (2011) Geoarchaeology

English Heritage (2011) Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector

English Heritage (2013) Marine Geophysics Data Acquisition, Processing and Interpretation

English Heritage (2013) People and the Sea: A Maritime Archaeological Research Agenda for England

Historic England (2015) Good Practice Advice in Planning Note 2 (GPA 2): Managing Significance in decision-taking in the Historic Environment

Historic England (2017) Conservation Principles for the Sustainable Management of the Historic Environment - consultation draft

Historic England (2020) Deposit Modelling and Archaeology

Joint Nautical Archaeology Policy Committee (2006) Code of Practice for Seabed Developers.

17 Material Assets

17.1 Introduction

This chapter presents an evaluation of the Celtic Interconnector Project in so far as it relates to or potentially interacts with material assets located in the UK Exclusive Economic Zone (EEZ).

Material assets are listed in Schedule 3 of the Marine Works (Environmental Impact Assessment) Regulations 2017 (as amended) as an aspect of the environment that should be considered by in the assessment of likely significant effects during the EIA process. These regulations and wider EIA guidance in the UK do not provide a definition of material assets and therefore this chapter uses the definition provided by the Irish 'EPA Guidelines on the information to be included in Environmental Impact Assessment Reports' (EPA, 2017) as material assets as 'built services and infrastructure'.

It is acknowledged in this regard, however, that the EPA 2017 guidelines are largely focused on the terrestrial environment, with reference to transport and waste management infrastructure. In the marine environment, material assets take a number of forms including power and telecommunication cables, pipelines, renewable power projects, oil and gas assets, marine aggregate resources, and communication structures. Waste management in the marine environment is also considered.

For the purposes of this chapter, material assets are defined as built services and infrastructure that have an economic or otherwise material value. These include those that may be operational or out of service.

This chapter describes the material assets that exist in the receiving environment and assesses the likely significance of effects of the Project on those assets. The objective of the assessment is to determine the potential for the Project to interact with or otherwise affect material assets identified within the area of search. The potential for likely significant effects during the installation, operation and decommissioning of the Project is considered. Any mitigation measures that are embedded into project design are noted and further mitigation measures are suggested where necessary in order to protect material assets and reduce any residual adverse impacts.

17.2 Methodology and Limitations

17.2.1 Legislation and Guidance

This chapter has been prepared with reference to relevant EU and UK legislation and guidance, notably the EIA Directive 2014/52/EU and the Marine Works (Environmental Impact Assessment) Regulations 2017 (as amended) as well as the Irish EPA Guidelines 2017 where appropriate.

Article 3(1) of the amended EIA Directive 2014 specifies that material assets should be identified, described and assessed.

17.2.2 Desktop Studies

The scope of this chapter was defined in the Technical Note that sets out the proposed scope and content of the UK Marine Licence Application and supporting Environment Report and Assessments that was submitted to the MMO for pre-application advice and comment in January 2021. The scope definition was based upon a desktop review of legislation, guidance documents, and current best practices in EIA, and informed by a review of datasets that identify material assets in the vicinity of the proposed interconnector route.

Table 17.1 presents the findings of the desktop scoping study. The potential impacts considered are listed alongside the rational for whether they were scoped in or out of the assessment:

Table 17.1 Material Assets Scope Definition

Potential impact	Scoped in or out	Rationale
Interactions with marine aggregate extraction activities	Scoped out	The nearest marine aggregate extraction areas are located approximately 200 km from the proposed cable route and therefore no interactions with the Project are anticipated.
Interactions with renewable power projects	Scoped out	The nearest renewable power project in the UK EEZ is the Wave Hub located over 70 km from the proposed cable route. No interactions with the Project are anticipated.
Interactions with oil and gas assets	Scoped out	There are no oil and gas assets located intersecting with or in the vicinity of the proposed cable route. No interactions with the Project are anticipated.
Risk of damage to existing in-service subsea cables at cable crossings intersected by the Project	Scoped in	Consultation with existing cable operators is required to determine the status of the cables, the appropriate installation methods for the cable and cable protection, and to determine any associated risks.
Interactions with PEXA	Scoped in	A naval PEXA is present off the southwestern coast of Cornwall and the Isles of Scilly. There is potential for PEXA activity to occur during the installation phase of the Project

A threshold of 500m on either side of the cable was used as a study area for the determination of potential impacts of the Project on material assets. This corresponds to the 500m indicative installation corridor that Project activities on the seabed will occur within.

The data used to inform the assessment of material assets are:

- KISORCA: The Kingfisher Information Service – Offshore Renewable and Cable Awareness project;
- EMODnet Central Portal for marine data in Europe;
- Crown Estate Open Data for offshore wind agreements;
- Oil and Gas Authority Open Data for the locations of oil and gas assets; and
- Admiralty Maritime Data Solutions Portal for Practice and Exercise Areas (PEXA).

17.2.3 Field Studies

Magnetometer surveys were completed along the length of the cable route in the UK EEZ, which have informed this chapter notably through the identification of existing subsea cables. These surveys are reported on in the following reports:

- Ireland to France Interconnector. Volume 2 – Geophysical Survey Results Report. Ref. no. CELTIC-SURV1415-GEO-R04-V02, February 2016. Report prepared for EirGrid and RTE by Osiris Projects and Bibby Hydromap.
- Celtic Interconnector Project. Marine Integrated Geophysical/Geotechnical Results Report. Ref. no. CELTIC-SURV1415-INT-R05-V01 Rev 05, February 2016. Report prepared for EirGrid and RTE by Bibby Hydromap.

17.2.4 Methodology for Assessment of Effects

The methodology used for the assessment of material assets is as described in Chapter 7: Assessment Approach. The evaluation of impacts has been undertaken in line with the EPA Guidelines 2017.

For the purposes of this chapter, the criteria used for the determination of impact magnitude and receptor sensitivity in relation to material assets are provided in Table 17.2.

Table 17.2 Impact magnitude and receptor sensitivity for material assets

	High	**Medium**	**Low**	**Negligible**
Receptor sensitivity	Receptor has little to no capacity to retain material asset value as a result of change to baseline conditions; damage to material assets results in major financial consequences; or assets of particularly high economic value	Receptor has some tolerance to change by retaining some material asset value in view of the change; damage to material assets results in minor financial consequences; or assets of	Receptor has high tolerance to change by retaining full material asset value in view of the change; damage to material assets results in no financial consequences;	Change to material asset value is undetectable in view of the change; damage to material assets cannot occur; or assets have negligible

		some economic value	or assets of low economic value	economic value
Impact Magnitude	Long term (>5 years) changes to material assets; a regional loss asset value; or other fundamental change to the baseline quality of available material assets	Medium term (<5 years) changes to material assets; a local loss of asset value; or other material change to the baseline quality of available material assets	Short term (<1 years) changes to material assets; a site-specific loss of asset value; changes are detectable but not material to the baseline quality of available material assets	Very little to no change from baseline conditions; or change is not detectable in relation to the overall quality of available material assets

17.2.5 Difficulties Encountered

Data concerning the location of naval and air force PEXA is available to view via Admiralty. However, the GIS data is not made available for download so it has not been possible to map PEXA in relation to the interconnector cable route. Data concerning the use of PEXA is also restricted for reasons of national security.

The Project has identified operational and decommissioned subsea cables that will be crossed along the interconnector route in Irish waters and in the UK and French jurisdictions. It is possible that additional cables exist in the marine environment that have not yet been identified. Some cables are particularly old with the earliest cables dating back to the 19th century, so mapping is consequently unreliable. Others may have become buried, are very small, or were otherwise not readily identified by the survey work undertaken.

Consultation with the European Subsea Cable Association (ESCA) and the owners or operators or existing cables may provide additional information that will inform operations during the installation phase on the Project.

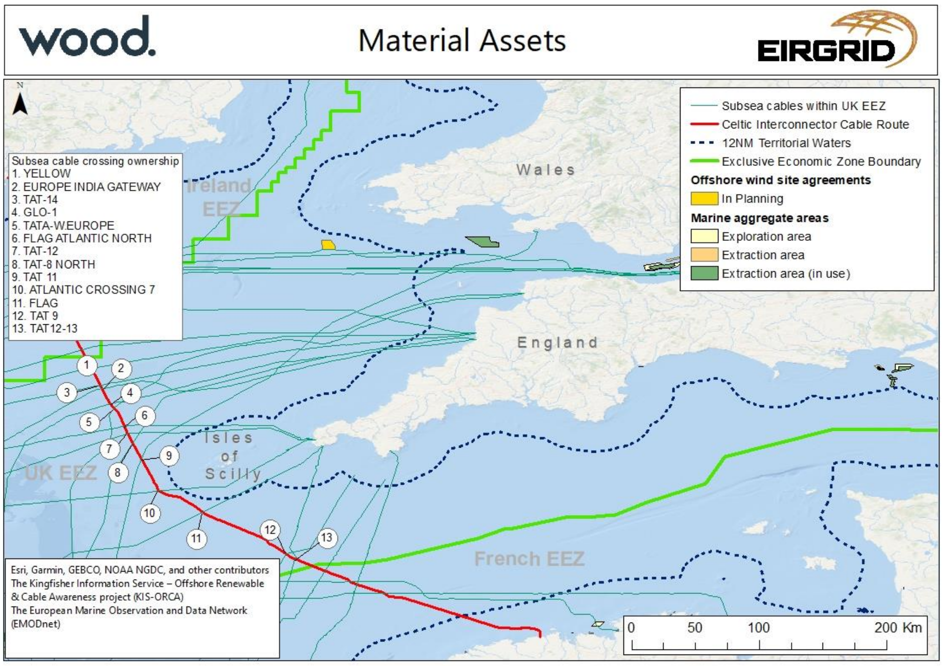
A communication was received by the Project from the US Navy in Washington noting its interest in the Project. It is possible that the US Navy owns defence system assets in Irish waters but due to reasons of US national security, the type and location of these is not available and consequently cannot be assessed in this chapter. The Project continues its liaison with the defence departments of Ireland, UK, France, the US, and other countries as required to reduce risk to the Project and to any relevant defence systems.

17.3 Receiving Environment

The review of datasets identified a small variety of material assets in the vicinity of the Celtic Interconnector cable route within the UK EEZ. In general terms, the Celtic Interconnector in the UK EEZ is located within an area of low density use by other industries compared with other marine areas around the UK. Shipping activities in the area are covered in Volume 4 Environmental Report for UK Offshore – Chapter 19: Shipping and Navigation.

Figure 17.1 illustrates the locations of material assets that are near to or intersect with the Project. Additional details describing the current status of these material assets are described below.

Figure 17.1 Material Assets in the UK EEZ



17.3.1 Renewable Power Developments

There are no offshore wind farm sites (existing, consented or in planning) located in the vicinity of the cable route as it passes thought the UK EEZ. The nearest is the Erebus demonstration site, which is in early planning and located approximately 200km from the cable route off the coast of Pembrokeshire. The Wave Hub is a fully commissioned wave power installation off the northern coast of Cornwall. It is located over 70km to the northeast of the proposed cable route. Given the location of these material assets in relation to the Project, there is no likely pathway for effects to these receptors and they are not considered further in the assessment.

17.3.2 Hydrocarbon Assets

The Celtic Interconnector cable route is located within Oil and Gas Authority (OGA) Quadrants 92, 84, and 85. There are very few oil and gas assets within these Quadrants and publicly available data from the OGA shows no oil and gas assets along the route nor within or near to the indicative 500m installation corridor.

The nearest hydrocarbons surface infrastructure is approximately 1.5km from the south coast of Cornwall near Porthleven. There are no hydrocarbons pipelines within these Quadrants and the nearest wells are approximately 40km the interconnector route (two to the northeast and one to the southwest), all of which are decommissioned.

The dataset shows that seismic surveys for hydrocarbons exploration have been undertaken in Quadrants 92, 84, and 85, most recently in 2016. The area was included in the OGA 29th Offshore Licencing Round in 2016 but there are currently no licenced blocks awarded. Given the location of these material assets in relation to the Project and their operational status, there is no likely pathway for effects to these receptors and they are not considered further in the assessment.

17.3.3 Marine Aggregate Resources

There are no marine aggregate licence areas near the proposed cable route in the UK EEZ. The nearest marine aggregates licence area is off the Welsh Gower coast approximately 200km to the northeast or near Bournemouth approximately 330km to the east. Given the location of these material assets in relation to the Project, there is no likely pathway for effects to these receptors and they are not considered further in the assessment.

17.3.4 Cables

The routes of existing subsea cables have been identified from the previously mentioned subsea surveys undertaken for the Project. The interconnector cable route intersects with 10 existing in-service cable routes, which include several trans-Atlantic cables. Within the UK EEZ, the Project intersects with the subsea cables listed in Table 17.3:

Table 17.3 Subsea Cables

Cable name	Cable owner	Description	KP crossing point	Status
Yellow	LEVEL 3	7,001km trans-Atlantic fibre optic telecommunications cable connecting the UK, Ireland, the United States of America (USA), and Canada	KP 159.6	Active
TAT-14	BT	15,428km trans-Atlantic submarine cable system, connecting the USA to the UK, France, the Netherlands, Germany, and Denmark	KP 173.8	Active

Cable name	Cable owner	Description	KP crossing point	Status
Europe India Gateway	VODAFONE	15,000km fibre optical Cable System between Europe, the Middle East and India	KP 176.7	Active
GLO-1	GLOBACOM LTD	9,800km submarine cable system connecting Bude in UK to Lagos in Nigeria and wider regions of West Africa	KP 189.6	Active
TATA-W. Europe	TATA COMMUNICATIONS	3,578km fibre optic cable system connecting the UK to Spain and Portugal	KP 193.3	Active
FLAG Atlantic North	GLOBAL CLOUD XCHANGE	14,500km fibre optic submarine telecommunications cable system connecting the UK and the USA	KP 208.5	Active
TAT-12	BT	Trans-Atlantic submarine cable between Cornwall and Rhode Island. Length unknown	KP 214.2	Active
TAT-8 North	BT	6,700km fibre optic cable system connecting the UK, France and the USA	KP 222.6	Withdrawn from service in 2002
TAT 11	VODAFONE	Trans-Atlantic submarine cable connecting the USA to UK. Length unknown	KP 235.7	Withdrawn from service in 2003
Atlantic Crossing 1	Century Link	Atlantic Crossing 1 cable, from Cornwall to New York, length unknown	KP 262.3	Active
FLAG	RELIANCE GLOBALCOM	28,000km fibre optic submarine telecommunications cable system. FLAG Europe-Asia (FEA) has landing points in Egypt, Jordan, Spain, United Arab Emirates, Saudi Arabia, Rep., Hong Kong, Japan, India, Italy, Malaysia, United Kingdom, Thailand and China	KP 290.6	Active
Rioja 1	BT	Fibre optic cable between Cornwall and northern Spain	KP 325.3	Withdrawn from service in 2006
TAT 9	BT	Trans-Atlantic cable connecting Cornwall to western France	KP 345.4	Withdrawn from service in 2004

Cable name	Cable owner	Description	KP crossing point	Status
TAT 12-13	BT	Trans-Atlantic cable connecting Porthcurno in Cornwall to Penmarch in northern France	KP 351.4	Active

17.3.5 Practice and Exercise Areas

The following Navy and Airforce PEXA are located within the UK EEZ in the vicinity of the cable route:

- A UK Navy department PEXA that extends over approximately 500km^2 from east of the Isle of Wight to approximately 50km west of the boundary between the Irish and UK EEZ.
- The Southern Fleet Exercise Area extends into Irish waters and is defined as “Aircraft general, general practice, submarine general (non-firing exercises, practices and trials)”.
- The South West Managed Danger Area (MDA) is a Royal Air Force department PEXA that extends from the north Cornwall coast near Bude out across the UK EEZ and over Irish EEZ waters approximately 80km east of Cork (areas A, B and C). It covers a sea area of approximately 150km^2.

It is possible to view GIS data layers for these PEXA through the Admiralty website, but the terms and conditions of use do not permit the data to be downloaded or reproduced.

The Celtic Interconnector is routed through the PEXA identified above, but each of these covers a substantial sea area and they are not in constant use by the navy or air force. Given the nature of the Project, with short-term installation followed by the long-term presence of the subsea interconnector cable, there is little potential for the Project to interact with navy or air force PEXA operations. The navy and air force will be consulted on the ER, with relevant views and sensitivities considered by the Project promoters. Consultation is ongoing since November 2020 with the UK Defence Infrastructure Organisation (DIO) within the UK Ministry of Defence (MOD) in order to avoid any potential conflicts with any existing subsea defence or security equipment during Project design. This consultation will continue as the Project progresses and the relevant defence departments will be further consulted on the ER, with relevant views and sensitivities considered by the Project promoters. There is no likely pathway for effects to these receptors and they are not considered further in the assessment.

17.3.6 Disposal Grounds

There are no dredge or military disposal sites in the vicinity of the proposed cable route in the UK EEZ. There is therefore no likely pathway for effects to these receptors and they are not considered further in the assessment.

17.4 Characteristics of the Development

17.4.1 Waste Generation

The installation of the Celtic Interconnector will produce the waste streams defined in Volume 4 Environmental Report for UK Offshore – Chapter 5: Project Description. Waste streams are likely to include waste-water including sewage, small quantities of general garbage comprising mixed food waste and food packaging, wider plastic and packaging waste such as polystyrene and cardboard, metals such as canisters, waste oils and lubricants, and electrical waste such as used batteries. These will require delivery to an appropriate licenced waste handling facility for recycling or disposal.

17.4.2 Installation of Cable Route

The Celtic Interconnector cable route and indicative installation corridor does not intersect with any areas designated for renewable power development, hydrocarbons production, marine aggregate extraction, or disposal grounds. Therefore, no likely significant effects to any such material assets are predicted. There are therefore no potential pathways for effect to these material asset receptors groups from the interconnector cable installation in the UK EEZ, so this Project activity is not considered further.

17.4.3 Installation of Cable Protection

The cable route intersects with some existing subsea cables in the UK EEZ. Cable crossings are commonplace in the engineering design of interconnector cables and the risk posed to existing cables is mitigated through design using cable protection and through early consultation with the cable owners and operators.

17.4.4 Operational Phase

Operational maintenance of the cable protection and cable crossings will be required where these occur in the UK EEZ, with repairs undertake where necessary to ensure the adequate protection of the Celtic Interconnector cable as well as of the cable crossed by the Project. Survey work using methods such as sub-bottom profiling is typically non-intrusive.

17.5 Likely Significant Impacts of the Development

The scope of the assessment is limited to impacts on onshore waste handling facilities and existing cables during installation. Impacts to hydrocarbons assets, marine aggregate resources, renewable energy, PEXA and disposal grounds were scoped out of the assessment in section 17.3.

17.5.1 Do Nothing

In the absence of the Project, material assets (i.e. existing subsea cables) will continue to be used throughout their operational lifetime and brought out of service at the appropriate time. Upon decommissioning, some subsea cables will be removed from the marine environment while others will be left in-situ depending on current legislative requirements, economic drivers, and industry best practice.

In the ‘Do Nothing’ scenario, the existing cable routes that are intersected by the Project will remain subject to risk in the existing marine environment from accidental damage by fishing gear, anchoring or foundering, or force majeure such as storm events. The likelihood of such events would not be impacted.

Onshore waste handling facilities and PEXA will continue to be used unaffected by the Project.

17.6 Construction Phase

17.6.1 Waste Generation

The waste streams produced during the installation of the Project will be transported to and processed by an appropriate licenced waste handling facility. The volumes of waste are expected to be low and in consequence, delivered to the waste handling facility over a short period of time during and shortly following the installation phase. This is expected to have a slight and temporary effect on the overall volumes of waste handled by the waste facility at that time, resulting in a low impact magnitude. The sensitivity of the waste handling facility is expected to be low as the waste stream volumes and types are expected to be within the normal operating capacity and capability of a licenced facility.

17.6.2 Existing Cables

The construction of the Project has the potential to result in damage to existing cable infrastructure where these occur within the UK EEZ, as a result of cable snagging during seabed preparation or installation works. It is also possible for the routing of the Project to compromise maintenance access for the owner or operator if the Project routing ran parallel or near-parallel to an existing operational cable.

Where this relates to live or operational cables, this could result in financial consequences for the cable owner or operator or for the promoters of the Celtic Interconnector Project. Where this relates to out-of-service cables and the damage was not pre-agreed through a Crossing Agreement, this could also result in a financial liability.

The sensitivity of existing cables is high due to their economic value and their importance for global communications. The magnitude of the effect for a damaged cable is low and the effect would be temporary until repairs could be undertaken. All subsea cables can be expected to require repair during their operational lifetime and cable operators are typically prepared to mobilise repairs quickly to minimise outage time. This would be likely to be undertaken within a year of damage occurring. The likelihood of damage to any given cable as a direct result of the Celtic Interconnector Project is also low as it has been designed to limit the potential for interactions with existing cables (section 17.8.2).

17.7 Operational Phase

17.7.1 Operational maintenance of cable crossings

Survey work required to establish any possible need for operational maintenance of the cable protection and cable crossings in the UK EEZ would use non-intrusive methods such as sub-bottom profiling, and as such would not impact upon existing subsea cables. Any necessary operational maintenance of the cable protection and cable crossings in the UK EEZ will be undertaken in line with the relevant cable crossing agreements, so any consequential risk to existing subsea cables is anticipated to be low.

17.7.2 Decommissioning Phase

A decommissioning plan will be prepared prior to the decommissioning phase of the proposed development, which is expected to be at least 40 years from the start of operation. It is currently anticipated that the cable and associated external cable protection will be left in-situ where this is deemed environmentally acceptable; this may require a level of long-term monitoring and maintenance. There are not expected to be any effects on material assets as a result of this proposed course of action. However, any works required for decommissioning will be subject to future consent applications, and environmental assessments, as relevant.

17.7.3 Cumulative Effects

No cumulative impacts are identified in relation to material assets.

17.8 Mitigation and Monitoring Measures

Commented [A53]: Placeholder: All mitigation measures remain under review / discussion, and will be confirmed prior to submission of the final Application File

17.8.1 Construction Phase – Waste generation

The appointed EPC contractor will be required to prepare a detailed WMP prior to commencing work. This will detail all the measures in place for the management of waste streams in the offshore environment. The objective of the WMP will be to minimise the impact of the Project on the environment at source and ensure effective environmental management throughout the development of the Project.

The installation of the Celtic Interconnector will be undertaken in line with UK law and international best practice. The EPC contractor will be required to prepare and work in accordance with a WMP that will include waste stream management procedures, and roles and responsibilities. It will include protocols for the correct handling, segregation, and disposal of waste in accordance with Annexes IV and V of the International Convention for the Prevention of Pollution from Ships (the MARPOL Convention), the Waste Framework Directive (2008/98EC), the Waste (England and Wales) Regulations 2011, and the MGN 385 Guidance on the Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008.

In line with the Waste Framework Directive (2008/98EC) and the Waste (England and Wales) Regulations 2011, waste will be managed in accordance with the waste hierarchy as defined by the EU Directive 2008/98/EC on Waste. This means that waste will be reduced, reused, recovered and recycled as far as reasonably practicable.

Vessels will manage on-board waste streams including wastewater and sewage in line with the MGN 385 Guidance on the Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008 as well as with the MARPOL Convention Annex IV relating to sewage management and Annex V relating to solid waste streams such as garbage.

Waste produced offshore will be stored in designated containers and returned to port by the EPC contractor. Onshore, waste will be segregated into designated containers that are made of materials appropriate to the content. Waste will be collected and disposed of by a licenced waste contractor.

17.8.2 Installation Phase - Existing cables

The Celtic Interconnector Project has been designed to be protected and to offer protection to cables that it must cross. This has been achieved through subsea surveys to identify the location and status of the cables, which resulted in the cable route design maintaining appropriate distances from existing cables and optimising crossing angles as close to 90° as possible.

Prior to seabed preparation and cable installation activities, all existing cables will be identified within 100m either side of the crossing point. The design of crossings is dependent on the configuration of each existing cable, as the amount and type of cable protection already employed will vary between cables. As described in Volume 4 Environmental Report for UK Offshore - Chapter 5: Project Description, cable burial is the preferred method of cable protection in so far as the underlying seabed geological conditions allow for. At the crossings with existing operational cables, cable burial may not be possible if the existing cable is already buried within the target depth of lowering for the Celtic Interconnector Project. In order to protect both cables in this instance, it is necessary to lay the cable without burial. Where the existing cable's depth of burial is sufficiently deep, the Celtic Interconnector cable will be laid directly on the seabed. Where the existing cable's depth of burial is shallow, the Celtic Interconnector cable will be laid on pre-lay concrete mattresses or rock to achieve adequate separation between the two cables. In either case, cable protection in the form of concrete mattresses or a rock berm will be installed over the Celtic Interconnector cable to protect it from risk of damage via fishing gear snagging or anchorage.

Consultation with relevant owners or operators also provides accurate data and information concerning the current status of the identified cables that has been used to inform design decisions. Initial contact has been made with all live cable owners and operators to establish the correct point of contact. An Information Pack has been prepared and is due to be shared with these consultees in 2021, which contains a presentation, route drawing, GIS route data, and typical crossing drawings. Further stages of consultation will include a request for accurate cable data from the owners or operators. Cable Crossing Agreements will between the project promoters and third-party cable owners or operators will then be prepared and put in place prior to commencement of works. These will be subject to negotiation with each individual cable owners or operators and customised accordingly. They will include the design and installation methods of the relevant cable crossing, which may vary in each case.

A draft Crossing Agreement template has been prepared based on industry standard as specified by the European Subsea Cables Association (ESCA) (previously the United Kingdom Cable Protection Committee, or UKCPC). It will be modified and tailored to the requirements of each specific cable crossing along the route. Each will include the following minimum content:

- Procedures for the work to be prepared;
- The approach to defining cable crossing locations, safety zones and notification areas;

- Notification periods including for before, during and after all pre-lay, installation and post-lay activities; and
- Details concerning the parties involves, liabilities, costs, duration and waivers.

Cable Crossing Agreements between the project promoters and third-party cable owners or operators will be in place prior to commencement of works. These will be subject to negotiation with each individual cable’s owners or operators and customised accordingly. They will include the design and installation methods of the relevant cable crossing, which may vary in each case.

Out-of-service cables will be identified and cleared as follows:

- Cables will be located by survey instrumentation or mechanical equipment such as a grapnel;
- Cables will be cut a minimum of 50m either side of the Crossing Point with the Celtic Interconnector; and
- Cables ends will be secured by dead-weights or burial.

Information to be recorded for out-of-service cable crossings will be:

- Coordinates of cutting and cable ends;
- Details of dead-weights; and
- Length of cable recovered or moved, including disposal method.

Details will be sought from the owners or operators of existing cables that must be crossed. Information will include (but not be limited to):

- Route position list to confirm crossing angle and date of the most recent survey;
- Water depth and condition of the existing cable including depth of burial and the extent of any seabed surface exposure;
- Physical specifications of the existing cable including diameter and type; and
- Location of any repeaters or other associated equipment.

17.9 Residual Impacts

The impact magnitude from waste generation is assessed as low due to the types and volumes of waste expected and the mitigation in place to ensure its correct handling. The sensitivity of the waste handling facility as the receptor to this impact is assessed as negligible as the types and volumes of waste expected will be within its capacity and capability. The residual impact of waste generation is therefore assessed as not significant.

Existing cables as material assets have been assessed as having a high sensitivity to damage due to their high economic value and importance for global communications. The impact magnitude has been assessed as low however, due to the temporary duration (<1 year) of the effect and the low likelihood of occurrence. Given the embedded mitigations described, the residual impact to existing cables is assessed as slight.

A summary of the assessment conclusions for material assets is provided in Table 17.4.

Table 17.4 Material Assets – Residual impacts

Potential impact	Magnitude	Sensitivity	Embedded mitigation	Residual impact
Waste generation	Low	Negligible	International best practice waste handling and use of licenced waste handling facilities	Not significant
Risk of damage to existing subsea cables at cable crossings intersected by the Project	Low	High	Consultation with existing cable operators, use of crossing-specific cable protection specifications, and approval of Cable Crossing Agreements prior to works	Slight

17.10 Conclusions

The assessment of material assets has considered the potential for the Project to impact upon offshore renewable power sites, hydrocarbons assets, existing subsea cables, marine aggregate licence areas, PEXA, disposal grounds, and licenced waste handling facilities. Offshore renewable power sites, hydrocarbons assets, marine aggregate resources, PEXA, and disposal grounds were all scoped out of the assessment due to their absence in the direct vicinity of the Project, their operational status, or low likelihood of an impact pathway.

The potential for the Project to impact upon licenced waste handling facilities and the crossings of numerous existing subsea cables was assessed.

The Celtic Interconnector Project does not pose a significant impact to onshore waste handling facilities due to the type and volumes of waste expected. Waste management will be undertaken in line with UK law and international regulation and best practice in the offshore environment. The necessary measures will be specified in the WMP including reference to roles and responsibilities and adherence to the WMP will be a contractual requirement for the EPC contractor.

A slight adverse impact has been identified in relation to existing cables due to the high economic value of these material assets. However, the mitigation inherent and embedded into the Project through the design of each cable crossing, and which will be agreed with cable owners and operators and confirmed by Cable Crossing Agreements prior to commencement of works, ensures that this is limited to as low as reasonably practicable.

17.11 References

Crown Estate Open Data for offshore wind agreements [online]. Available at: https://opendata-thecrownestate.opendata.arcgis.com/

EMODnet Central Portal for marine data in Europe [online]. Available at: https://www.emodnet.eu/geoviewer/#!/

MGN 385 (M+F) Guidance on the merchant shipping (prevention of pollution by sewage and garbage from ships) regulations (2008) Available online at: https://www.gov.uk/government/publications/mgn-385-prevention-of-pollution-by-sewage-and-garbage-from-ships-regulations-2008

Oil and Gas Authority ArcGIS Web Application [online]. Available at: https://ogauthority.maps.arcgis.com/apps/webappviewer

Oil and Gas Authority Open Data for the locations of oil and gas assets [online]. Available at: https://data-ogauthority.opendata.arcgis.com/

The Kingfisher Information Service – Offshore Renewable and Cable Awareness (KISORCA) project [online]. Available at: http://www.kis-orca.eu

18 Noise and Vibration

18.1 Introduction

Certain marine species use sound for communication, navigation, and the identification of prey (further information on this is provided in Volume 4 Environmental Report for UK Offshore – Chapter 14: Biodiversity. Sound sources exist naturally in the marine environment, and marine fauna are typically adapted to these. The installation of the Celtic Interconnector Project has the potential to introduce anthropogenic sound sources to the marine environment that could be above the ambient sound levels of the receiving environment in terms of sound source level as measured in decibels (dB) or that are within frequency ranges that coincide with those used by marine fauna. This can impact upon the ability of marine fauna to use sound for the aforementioned purposes, and in extreme cases can cause physical injury to the auditory mechanisms of affected animals or mortality.

The Environment Report for the Celtic Interconnector largely takes a receptor-led approach, meaning that the technical chapters assess potential impacts to specific receptors or receptor groups from Project activities. The introduction of Project-related noise and vibration to the environment has the potential to interact with and impact upon certain receptors that are defined in other chapters. The purpose of this chapter is to provide contextual information specific to the field of underwater noise that is used to inform the receptor-led assessment. This chapter characterises the baseline receiving environment for underwater noise and vibration in the vicinity of the cable route and defines the likely sound source levels and frequency ranges of the proposed works in the marine environment.

By way of general context, it is informative to note that, according to the Oslo / Paris convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), sound emissions associated with the installation, removal or operation of submarine cables are considered as less harmful compared to activities such as seismic surveys, military activities or construction work involving pile driving (OSPAR Commission, 2012).

The assessment of noise and vibration is relevant where a receptor that is sensitive to the sound source exists. Sensitive marine fauna and the assessment of underwater noise and vibration on relevant species that have potential to occur in the vicinity of the Project are described in Volume 4 Environmental Report for UK Offshore – Chapter 14: Biodiversity.

Given the offshore location of the interconnector cable in the UK EEZ, there are no human receptors to noise and subsea cable installation is not anticipated to be audible to land-based human receptors. Noise impacts to human receptors are scoped out of the ER.

18.2 Methodology and Limitations

18.2.1 Legislation and Guidance

Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive, or MSFD) sets descriptors for the achievement of

Good Environmental Status (GES). Under the MSFD, GES Descriptor 11 states that, the *"introduction of energy (including underwater noise) does not adversely affect the ecosystem"*. This is applicable to the marine waters of the UK EEZ including waters in the vicinity of the Project and is implemented in the UK through the Marine Strategy Regulations 2010. Further information is included in the MSFD Assessment.

In relation to marine fauna as receptors to underwater noise, marine fauna is afforded protection in the UK EEZ through the Conservation of Habitats and Species Regulations 2017, and the Conservation of Offshore Marine Habitats and Species Regulations 2017. These regulations make it an offence to kill, injure or disturb marine European Protected Species (EPS) as designated under EC Directive 92/43/EEC, known as the Habitats Directive. EPS includes all species of dolphins, porpoises and whales. Volume 4 Environmental Report for UK Offshore – Chapter 14: Biodiversity provides further detail on marine fauna including the sensitivity of relevant species to underwater noise.

The Joint Nature Conservation Committee (JNCC) has published guidance regarding the protection of EPS from injury and disturbance (JNCC, 2010a), which serves as a reference in the consideration of activities in relation to their potential to create an unlawful disturbance to EPS.

JNCC has also developed marine mammal mitigation guidelines (JNCC, 2020) that are primarily designed to mitigate the potential impacts of impulsive noise sources to marine mammals but that can also be applied to other types of sound source. JNCC states that, "*compliance with JNCC's mitigation guidelines is considered best practice and will, in most cases, reduce the risk of deliberate injury to marine mammals to negligible levels".*

In 2012, The OSPAR Commission produced *Guidelines on Best Environmental Practice (BEP) in Cable Laying and Operation* (OSPAR Commission, 2012). The guidance differentiated the various types of sea cables and installation techniques, compiled mitigation measures to avoid and mitigate potential ecological impacts arising and identified knowledge gaps. Noise was not identified in this guidance as one of the primary sources of ecological impact requiring mitigation. The guidance stated that generally, maximum sound pressure levels related to the installation or operation of cables was *"moderate to low"*. However, only one publication of recordings of noise emissions during cable laying was identified by the authors (Nedwell et al. 2003; of a UK windfarm, which measured noise from cable trenching). The guidance acknowledged and highlighted such knowledge gaps at that time, and the need to determine noise generated from different burial techniques in different sediment types.

18.2.2 Desktop Studies

A review of documents available from the UK Government in relation to its approach to the MSFD has been undertaken. In 2019, the Department for Environment Food and Rural Affairs (DEFRA) published a Marine Strategy Part One consultation document (DEFRA, 2019) on the UK's progress towards achievement of GES and the UK Government's proposals for updating the UK Marine Strategy published in 2012. Part of the measures taken since 2012 was the establishment of a noise registry that records impulsive noise in the marine environment and a monitoring programme designed to monitor trends in ambient noise levels in the sea. This nationally coordinated approach to quantifying underwater noise in the UK EEZ involved monitoring at 12 sites around the UK, including one in the Celtic Sea. The findings of this work have been published (Merchant et al., 2016) and modelled mapping has been developed by the Marine Management Organisation (MMO) (MMO Project No. 1097) (MMO, 2015). These data sources that have been used to inform and characterise the noise and vibration baseline in this chapter of the ER (Chapter 18). Further information is included in the MSFD Assessment.

18.3 Field Studies

Given the temporally transient nature of sound, there was determined to be no value in undertaking project-specific surveys of in-air or underwater ambient noise conditions during the planning and design phases of the Celtic Interconnector Project. However, the potential for noise generation was included as an environmental constraint in the development of alternatives when assessing the individual route options. Environmental input to optioneering noted that there was potential for higher levels of underwater noise where rock-cutting would be required, compared to standard trenching or cutting installation methods. The realistic worst case for the use of rock-cutting in the UK EEZ is defined in Volume 4 Environmental Report for UK Offshore - Chapter 5: Project Description.

18.3.1 Methodology for Assessment of Effects

The methodology for assessing the effects of underwater noise on faunal receptors is presented in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity.

18.3.2 Limitations

No notable difficulties were encountered in the development of this chapter.

18.4 Receiving Environment

Underwater noise and vibration can arise from natural and anthropogenic sources and has the potential to affect acoustically sensitive species, and through this, the overall functioning of marine ecosystems. The capacity of water to readily transmit noise and vibration means that there is potential for sensitive receptors at many kilometres from the sound source to be affected by noise, primarily during the installation phase of the Project. Sensitive species are typically marine mammals that use high-frequency sound for communication such as harbour porpoise (*Phocoena phocoena*). Further information on sensitive species is presented in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity.

Merchant et al (2016) reported field measurements of underwater noise at 12 sites around the UK, with data for the Celtic Sea monitored at a site located off the south-western tip of Cornwall. The Celtic Sea monitoring location is located over 150km from the Celtic Interconnector cable route at its nearest point in the UK EEZ, but this is the only monitoring location in the Celtic Sea so it is taken to be broadly indicative of underwater sound levels that can be expected within the receiving environment in the UK EEZ. The study identified the Celtic Sea monitoring site dataset as being the least affected by anthropogenic sound of

Commented [A54]: A check to confirm no additional data is available at a closer location will be undertaken.

all the monitored sites. The Celtic Sea monitoring site was located 15km east of a convergence of shipping lanes, but the site was characterised predominantly by sound levels below 125Hz with a median sound pressure level of 83.2dB re 1µPa and a 90th percentile of 93.3dB re 1µPa. Higher frequency ranges were detected at 250Hz and 500Hz with median sound pressure levels of 87.1 and 89.7dB re 1µPa respectively, but these readings were infrequent. The data identified wind-generated noise as the primary driver of variability, with peaks of heightened noise levels above 100Hz. This indicates that there was little acoustic influence of shipping or other anthropogenic activities at this monitoring site, with natural sound sources being dominant.

In line with the data described by Sutton et al (2014) and Merchant et al (2016), the underwater noise and vibration environment along the cable route is dominated by natural sound sources such as wind and wave action. The vocalisations of marine fauna including birds and marine mammals in air and underwater are present and occasional continuous anthropogenic sound sources such as vessel engines and helicopters may be detectable periodically. This includes the movements of commercial and recreational vessels (Volume 4 Environmental Report for UK Offshore - Chapter 19: Shipping and Navigation) as well as vessels and helicopters operated by the Maritime and Coastguard Agency (MCA), the Royal Navy, Royal Airforce, and the ferry services that operate from Cork and Rosslare to Roscoff and Cherbourg in France and to Bilbao in Spain.

The open ocean environment of UK EEZ waters is similarly characterised in terms of underwater noise and vibration by natural sound sources such as wave action and faunal vocalisations and by anthropogenic sources such as vessel engines. In the UK EEZ, these are typically large vessels and may include fishing vessels, ferries, and cargo vessels of varying sizes such as container ships, tankers, and dry bulk carriers. The use of sonar in navigation and by fishing vessels for targeting shoals also propagates sound into the marine environment.

18.5 Characteristics of the Development

Underwater sound will be produced during the installation of the cable as a result of vessels, ancillary equipment and machinery, seabed preparation activities, cable laying, and the installation of cable protection. The vessel types that will be used during the installation phase are described in Volume 4 Environmental Report for UK Offshore - Chapter 5: Project Description. Source terms for vessels and cable installation techniques have been published in numerous studies, often in relation to offshore wind developments. Within the UK EEZ, the principal noise sources of the Project and the noise levels likely to be propagated during the relevant activities are presented in Table 18.1.

Table 18.1 Noise and Vibration Characteristics of the Project

Noise and vibration source	Source term description	Approximate unweighted source levels	Likely frequency banding	Data source
Support vessel engines	Continuous broadband noise from gearbox, propeller resonance and propeller cavitation – data refers to small to mid-sized vessels between 50-100m in length, with source levels and frequencies varying relative to hull dimensions, speed and engine power.	155 to 180 dB re 1 µPa @ 1m depending on vessel type, with guard vessels typically at the lower end of the range	20 Hz to >10 kHz	OSPAR Commission, 2009; Sutton et al, 2014
Cable lay vessel engines	Continuous broadband noise from gearbox, propeller resonance and propeller cavitation – data refers to vessels 50-100 m in length with source levels and frequencies varying as stated above.	155 to 180 dB re 1 µPa @ 1m depending on vessel type, with the cable lay vessel expected to be at the higher end of the range	Up to 1 kHz	OSPAR Commission, 2009
Cable protection installation vessel using Dynamic Positioning (DP)	Continuous broadband noise whilst operational. A previous study of rock deployment within the Yell Sound (Nedwell, 2004), Shetland found that the noise of rock placement from vessels could not be detected by monitoring equipment above the levels of vessel noise recorded, with no notable difference between the vessel's noise levels when placing and not placing rock protection. Therefore, noise associated with placement of cable protection is accounted for under the assessment of the cable protection installation vessel noise.	121 to 148 dB re 1 µPa @ 1m	Broadband up to 35 kHz	Nedwell and Edwards, 2004; Fischer, 2000; Prideaux, 2017; Wyatt, 2008
Subsea survey and monitoring equipment	Impulsive sound from equipment such as chirp sub bottom profiler.	213-228 dB re 1 µPa @ 1m	1.8 to 5.3kHz	Le Gall et al., 2016
Cable laying with trenching	Continuous broadband noise, tonal machinery noise and transients with source term characteristics determined by	178 dB re 1 µPa @ 1m (if a transmission loss of 22	Broadband with peaks	Nedwell et al, 2003

Noise and vibration source	Source term description	Approximate unweighted source levels	Likely frequency banding	Data source
	the physical properties of the substrate.	log(R) is assumed)	around 40-50 kHz	

18.6 Likely Significant Impacts of the Development

18.6.1 Do Nothing

Given that the baseline environment is characterised largely by natural sound sources and shipping, the baseline ambient noise levels could be expected to gradually increase over time as a result of climate change leading to an associated increased frequency of storm events and as a result of increasing shipping in line with economic drivers and demand. None of these longer-term baseline scenarios for underwater noise are influenced by the Project under the do nothing alternative.

18.6.2 Installation Phase

18.6.2.1 Vessel noise during installation

Installation vessels primarily generate underwater noise from their engines, propellers, navigation systems, dynamic positioning (DP) systems, and on-board machinery. These types of sounds will be propagated during the installation of the cable and cable protection as well as during later maintenance activities during the operational phase. There is potential for these sound sources to influence the behaviour of cetaceans and pinnipeds and their use of sound for navigation, communication and for the identification of prey. The potential for behavioural changes and other non-lethal effects on these receptors is assessed in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity.

18.6.2.2 Noise and vibration through use of subsea survey and monitoring equipment (installation phase)

Similarly to the effect described above, the source levels and frequencies propagated by subsea survey and monitoring equipment such as sub bottom profiling have potential to influence the behaviour of certain sensitive marine fauna and cause injury or mortality in extreme cases. This is assessed in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity.

18.6.2.3 Noise and vibration through installation of external cable protection

Previous studies of rock deployment within the Yell Sound, Shetland found that the noise of rock placement from vessels could not be detected by monitoring equipment above the vessel noise, with no clear difference between the vessel's noise levels when placing and not placing rock protection (Nedwell, 2004). The measurements were taken using a hydrophone at distances ranging from 200m to 10km from the sound sources and at depths varying between 1m to 200m. Therefore, noise associated with placement of cable protection is accounted for under the assessment of vessel noise in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity and is not assessed separately.

18.6.2.4 Noise and vibration through detonation of UXO during preparation for cable installation

Magnetometer surveys undertaken to date (in 2015 and 2018) have not identified a high potential for UXO targets along the cable route in the UK EEZ. Pre-installation surveys of the cable route will further determine the presence of any UXO. In the unlikely event that the pre-installation survey does identify UXO, these will subsequently be either detonated in situ, or removed to be detonated elsewhere. Any such works to UXOs will be carried out under licence held by the EPC contractor, informed by relevant environmental assessments, guidance and in line with the JNCC guidelines for minimising risk of disturbance and injury to marine mammals from using explosives (JNCC, 2010b). As UXO targets are not expected along the cable route in the UK EEZ and that there is a commitment to best practice mitigation in the unlikely event that any are discovered, the likelihood of any significant effects is negligible, so this has been scoped out of the Environmental Report and is not considered further.

Commented [A55]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

18.6.3 Operational Phase

18.6.3.1 Noise and vibration through use of subsea survey and monitoring equipment during the operational phase

The use of vessels deploying subsea survey and monitoring equipment such as sub bottom profiler for completion of periodic operational maintenance surveys will use similar equipment and methods to those described during installation. During the operational phase, this will typically occur over more limited and focused areas than during installation. The potential for noise associated with these activities to impact fauna is assessed in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity.

No further noise sources are anticipated during the operational phase of the Project.

18.6.4 Decommissioning Phase

A decommissioning plan will be prepared prior to the decommissioning phase of the proposed development, which is expected to be at least 40 years from the start of operation. It is currently anticipated that the cable and associated external cable protection will be left in-situ where this is deemed environmentally acceptable; this may require a level of long-term monitoring and maintenance. There are not expected to be any effects on noise and vibration as a result of this proposed course of action. However, any works required for decommissioning will be subject to future consent applications, and environmental assessments, as relevant.

18.6.5 Cumulative Effects

There are no further developments in the vicinity of the landfall or interconnector cable route in the UK EEZ (either in construction or in planning) that have the potential to give rise to significant cumulative effects in terms of noise.

18.7 Mitigation and Monitoring Measures

Commented [A56]: Placeholder: All mitigation measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

18.7.1 Installation Phase

The implementation of installation phase mitigation relating to underwater noise sources is detailed in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity. Vessels used by the Project will be operated and maintained in line with International Maritime Organisation (IMO) Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life (MEPC.1/Circ.833). Relevant design considerations from these guidelines may include:

- Propeller design to reduce cavitation (i.e. the formation and implosion of water vapour cavities caused by the decrease and increase in pressure as water moves across the propeller blade);
- Selection of onboard machinery and engines with in-built noise reduction technology and/or appropriate vibration control measures;
- Proper location of equipment in the hull;
- Optimisation of foundation structures such as vibration isolation mounts that may contribute to reducing underwater radiated noise; and
- Effective maintenance to reduce noise and vibration.

Operations in the UK marine environment will be undertaken in line with the JNCC guidance regarding the protection of EPS from injury and disturbance (JNCC, 2010a) and the JNCC marine mammal mitigation guidelines (JNCC, 2020).

18.7.2 Operational Phase

The implementation of operational phase mitigation relating to underwater noise sources is detailed in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity. Vessels will be operated and maintained in line with IMO Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life (IMO, 2014) as previously stated.

18.7.3 Residual Impacts

Residual impacts relate to marine fauna and are therefore described in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity.

18.7.4 References

DEFRA, 2019. Marine Strategy Part One: UK updated assessment and Good Environmental Status. Consultation documents, May 2019 [online]. Available from:

https://consult.defra.gov.uk/marine/updated-uk-marine-strategy-part-one/supporting_documents/UKmarinestrategypart1consultdocumentfinal.pdf

Fischer, R., 2000. Bow Thruster Induced Noise and Vibration. Dynamic Positioning Committee – Marine Technology Society. Dynamic Positioning Conference October 17-18 2000 [online]. Available from: https://dynamic-positioning.com/proceedings/dp2000/design_fischer.pdf [Accessed Nov 2020].

Gutowski, M., Bull, J., Henstock, T., Dix, J., Hogarth, P., Leighton, T., and White, P., (2002). Chirp sub-bottom profiler source signature design and field testing. Marine Geophysical Researches, 23: 481-492. Kluwer Academic Publishers, The Netherlands

IMO, 2014. IMO MEPC.1/Circ.833: Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life. International Maritime Organisation. 21st ASCOBANS Advisory Committee Meeting. Gothenburg, Sweden, 29 September – 1 October 2014.

JNCC, 2010a. The protection of marine European Protected Species from injury and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area. Joint Nature Conservation Committee, Natural England and Countryside Council for Wales. [online]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850708/Draft_Guidance_on_the_Protection_of_Marine_European_Protected_Species_from_Injurt_and_Disturbance.pdf [Accessed Dec 2020].

JNCC, 2010b. JNCC guidelines for minimising risk of disturbance and injury to marine mammals from using explosives [online]. Available from: https://data.jncc.gov.uk/data/24cc180d-4030-49dd-8977-a04ebe0d7aca/JNCC-Guidelines-Explosives-Guidelines-201008-Web.pdf [Accessed Dec 2020].

JNCC, 2020. Marine mammals and noise mitigation [online]. Available from: https://jncc.gov.uk/our-work/marine-mammals-and-noise-mitigation/ [Accessed Dec 2020].

Le Gall, Y., Lurton, X., Ducatel, C, and Nokin, M., 2016. Acoustic impact assessment of sub-bottom profilers on marine mammals. Ifremer. Available from: https://archimer.ifremer.fr/doc/00368/47969/47993.pdf

Merchant, N., Brookes, K., Faulkner, R. et al. Underwater noise levels in UK waters. Sci Rep 6, 36942 (2016) [online]. Available from: https://doi.org/10.1038/srep36942 [Accessed Dec 2020].

MMO, 2015. Modelled Mapping of Continuous Underwater Noise Generated by Activities. A report produced for the Marine Management Organisation, pp 50. MMO Project No: 1097. ISBN: 978-1-909452-87-9.

Nedwell J., & Edwards B., 2004. A review of the measurements of underwater man-made noise carried out by Subacoustech Ltd 1993 – 2003. Subacoustech 134.

Nedwell, J., Langworthy J., and Howell, D., 2003. Assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife; initial measurements of underwater noise during construction of offshore windfarms, and comparison with background noise. Report commissioned by COWRIE, May 2003 [online]. Available from: https://tethys.pnnl.gov/sites/default/files/publications/Noise_and_Vibration_from_Offshore_Wind_Turbines_on_Marine_Wildlife.pdf [Accessed Nov 2020].

OSPAR Commission 2009. Overview of the impacts of anthropogenic sound in the marine environment [online]. Available from: https://tethys.pnnl.gov/sites/default/files/publications/Anthropogenic_Underwater_Sound_in_the_Marine_Environment.pdf [Accessed Nov 2020].

OSPAR Commission, 2012. OSPAR Commission, 2012. Guidelines on Best Environmental Practice (BEP) in Cable Laying and Operation (Agreement 2012-2). Source: OSPAR 12/22/1, Annex 14, EIHA 17/9/1, Annex 8. [online]. Available from: Available online from: https://www.ospar.org/documents?d=32910.

Prideaux G, 2017, 'Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities', Convention on Migratory Species of Wild Animals, Bonn.

Sutton, G., Jessopp, M., Clorennec, D., and Folegot T., 2014. Mapping the spatio-temporal distribution of underwater noise in Irish waters (2011-W-MS-7). Environmental Protection Agency.

Wyatt, R. 2008. "Joint Industry Programme on Sound and Marine Life - Review of Existing Data on Underwater Sounds Produced by the Oil and Gas Industry."

19 Shipping and Navigation

19.1 Introduction

This chapter considers the potential for effects to arise on the navigation of vessels within the UK Exclusive Economic Zone (EEZ), as a result of installation and subsequent presence of the proposed Celtic Interconnector.

Vessel operation may also present risks to the interconnector cables, for example through damage from ships' anchors, ships grounding or foundering, or through interaction with fishing gear. These risks have been taken into account in the design process and appropriate mitigation measures (cable routeing, cable burial and cable protection) have been incorporated into project design. Such risks to the cables are not considered in this chapter, although some information on such aspects is included in the navigation risk assessment attached at Appendix xx to this Environmental Report (ER), which also provides supporting information for the environmental appraisal aspects.

Commented [A57]: Appendix to be added into the final application file

This chapter focusses on effects of the interconnector project on the navigation of vessels. In addition, construction activity and subsequent presence of the cables may have an effect on the ability of commercial fishing vessels to access their normal fishing areas during construction or to deploy certain types of bottom gear (for example trawls and dredges) subsequently. The effects of the project on fishing activity specifically are covered in Volume 4 Environmental Report for UK Offshore:

- Chapter 9: Population and Human Health; and
- Chapter 20: Commercial Fisheries.

Consideration of fishing vessels in this chapter relates solely to effects on navigation, which apply to all types of vessel.

19.2 Methodology and Limitations

19.2.1 Legislation and Guidance

The wider legislative and policy context is set out in Volume 4 Environmental Report for UK Offshore - Chapter 2: Relevant Policy and Legislation. The principal additional legislation relevant to this chapter is that relating to safe navigation of vessels, as set out below.

UNCLOS

The United Nations Convention on the Law of the Sea 1982 (UNCLOS) defines the rights and responsibilities of nations with respect to their use of the world's oceans. It establishes guidelines for businesses, the environment, and the management of marine natural resources, and establishes the right of innocent passage for vessels of one state passing through the territorial waters of another state.

COLREGS

The International Regulations for Preventing Collision at Sea 1972 (COLREGS) set out the navigation rules to be followed by ships and other vessels at sea to prevent collision between two or more vessels. The international regulations are transposed into UK law through The Merchant Shipping (Distress Signals and Prevention of Collisions) Regulations 1996 (S.I. 1996:75).

SOLAS

Chapter V, Safety of Navigation, of the Annex to the International Convention for the Safety of Life at Sea (SOLAS) sets out the navigational equipment to be carried on board ships. This includes a requirement for all ships of 300 gross tonnage (GT) and upwards engaged on international voyages, cargo ships of 500GT and upwards not engaged on international voyages, passenger ships irrespective of size and fishing vessels exceeding 15m in length to carry Automatic Identification System (AIS) equipment. AIS is a system which allows the position of each vessel to be transmitted at frequent intervals to other vessels and shore stations / marine authorities. Ships fitted with AIS must maintain AIS in operation at all times while on passage, except where international agreements, rules or standards provide for the protection of navigational information.

A proportion of smaller fishing vessels and recreational craft carry AIS but this is voluntary and they may not broadcast continuously.

The international rules are transposed into UK law through The Merchant Shipping (Vessel Traffic Monitoring and Reporting Requirements) Regulations 2004 (S.I. 2004:2110) (as amended).

Notices to Mariners

Notices to Mariners are information notices issued by the UK Hydrographic Office (UKHO), Trinity House and local port authorities to publicise important safety, regulatory and other information relating to the maritime sector in the UK. This system will be used to advise shipping of project-related vessel activity and any advisory safety precautions for passing vessels established in connection with installation arrangements for the cable.

19.2.2 Desktop Studies

In 2013, Anatec was commissioned to prepare a brief 'High-level review of shipping and navigational features' in the vicinity of four potential cable routes being examined between Ireland and France, to aid in cable routeing. Subsequently EirGrid and RTE commissioned a more detailed 'Shipping and fishing - cable risk assessment' for the preferred cable route West of the Scilly Isles, reported in 2016. These reports are attached as Appendix 19B of the ER.

Commented [A58]: Appendix to be added into the final application file

Review of available project reports identified that data relevant to the assessment of effects of the Celtic Interconnector (UK EEZ section) on shipping, fishing and recreational vessels are available in the following project reports:

- Ireland to France Cable Route. Shipping and Navigational Features. High Level Review (Technical Note). Ref. no. A3225-INT-TN-0. December 2013. Prepared for Intertek by Anatec Limited;

- Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Ref. no. A3728-RTE-RA-2, Rev. 4. April 2016. Report prepared for EirGrid and RTE by Anatec Limited (Appendix 19B to this ER);
- Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Appendix A – Data validation. Ref. no. A3728-RTE-AP-1, Rev. 1. January 2016. Report prepared for EirGrid and RTE by Anatec Limited; and
- Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Appendix B – VMS Fishing analysis. Ref. no. A3728-RTE-AP-2, Rev. 1. January 2016. Report prepared for EirGrid and RTE by Anatec Limited.

Although principally undertaken to provide an assessment of potential risks to the cable and to guide engineering design and routeing of the cable, these reports provide information on shipping activity, based on records from AIS, along with information on vessel sizes, anchoring requirements and anchor dragging risks along the cable route within the UK EEZ. This includes records of activity of fishing vessels fitted with AIS and records from Vessel Monitoring Service (VMS) satellite fishing data. Additional information is provided on recreational vessels, most of which do not have AIS.

The data are based on 12 months of AIS records, covering two separate 6-month periods in 2014 and 2015 but, as there have been no significant developments at local ports since then that would result in significant changes to vessel routeing, the data are considered still to provide a valid baseline for the current impact assessment. The reports also present data collated by the UK Marine Accident Investigation Board (MAIB) on ship foundering within 50 nautical miles (nm) of the cable route (including incidents affecting UK vessels in Irish waters).

Note also that the Anatec reports referenced consider two potential cable landfall sites, at Ballycroneen and Ballinwilling. The selected landfall site now being progressed is at Claycastle Beach, immediately to the west of Youghal and the Blackwater Estuary. This change does not affect the cable route in the UK EEZ and the reports provide all the data required to assess the impacts of the Celtic Interconnector project on navigation in the UK EEZ.

Small recreational vessels and small fishing craft are not required to carry AIS equipment; however, numbers of such vessels operating within the UK EEZ (i.e. at a minimum of over 12nm (20km) from land) are expected to be minimal. A more detailed description of the activity of fishing vessels is included in Volume 4 Environmental Report for UK Offshore - Chapter 20: Commercial Fisheries of the ER. As these are shallow-draughted vessels and water depth along the cable route in the UK EEZ is a minimum of 90m below chart datum (BCD), the effects on navigation of such vessels will be confined to temporary interference with passage due to presence of work vessels and potentially an advisory safety zone around work vessels during cable installation. It was therefore not considered necessary to obtain detailed information on levels of activity of such vessels.

Other sources of data used were:

- Admiralty Sailing Directions, Irish Coast Pilot, NP40. 21st Edition, UKHO, 2019;

- Admiralty Sailing Directions, Channel Pilot, NP27, 9th Edition, UKHO, 2011; and
- UK Admiralty Chart 1123 – Western approaches to St George's Channel and Bristol Channel and Chart 2649 – Western approaches to the English Channel.

19.2.3 Field Studies

As all larger vessels are now obliged to carry AIS equipment and to operate it when under way or fishing, field observations of such vessels was not required, as full details of vessel movements are available from AIS records, supplemented by radar data.

As explained in section 19.2.2, it was not deemed necessary to undertake field studies to obtain quantitative data on small fishing vessel and recreational vessel activity for the purposes of the EIA.

19.2.4 Methodology for Assessment of Effects

The generic project-wide approach to EIA is set out in Volume 4 Environmental Report for UK Offshore - Chapter 7: Assessment Approach.

In terms of assessment of effects on navigation, the process has involved the following steps:

- Definition of the baseline navigation activity (including passage and anchoring) across the proposed cable route (receptors of potential effects);
- Identification of potential effects of cable installation and presence of the cable on navigation activity (as distinct from risks to the cable from shipping, which is relevant to the project design process but not the EIA process);
- Identification of magnitude of effects (degree of disruption or hazard), spatial scale and duration of effects, including identification of where the design of the development avoids or minimises adverse effects;
- Assessment of significance of effects;
- Identification and assessment of any cumulative effects; and
- Identification of any proposed mitigation and monitoring.

This chapter is concerned with the effects of cable installation works and subsequent presence of the cable on navigation activity in the UK EEZ, including anchoring, and any potential restrictions on navigation activity caused by the Celtic Interconnector Project. It should be noted that ship anchoring (including in an emergency), anchor dragging and foundering of vessels can present risks to the cable and these are addressed in the Anatec reports attached as Appendix 19B to this ER. However, these aspects are not the subject of this ER chapter.

Commented [A59]: Appendix to be added into the final application file

19.2.5 Difficulties Encountered

AIS equipment carriage is not mandatory for all vessels. Military vessels and small craft such as fishing vessels below 15m in length and recreational craft are not required to carry AIS and are therefore not included in the plots showing AIS data. Similarly, fishing vessels below

15m in length are not recorded in VMS satellite fishing data, as described in Anatec report A3728, Appendix B (Appendix 19B of the ER).

Commented [A60]: Appendix to be added into the final application file

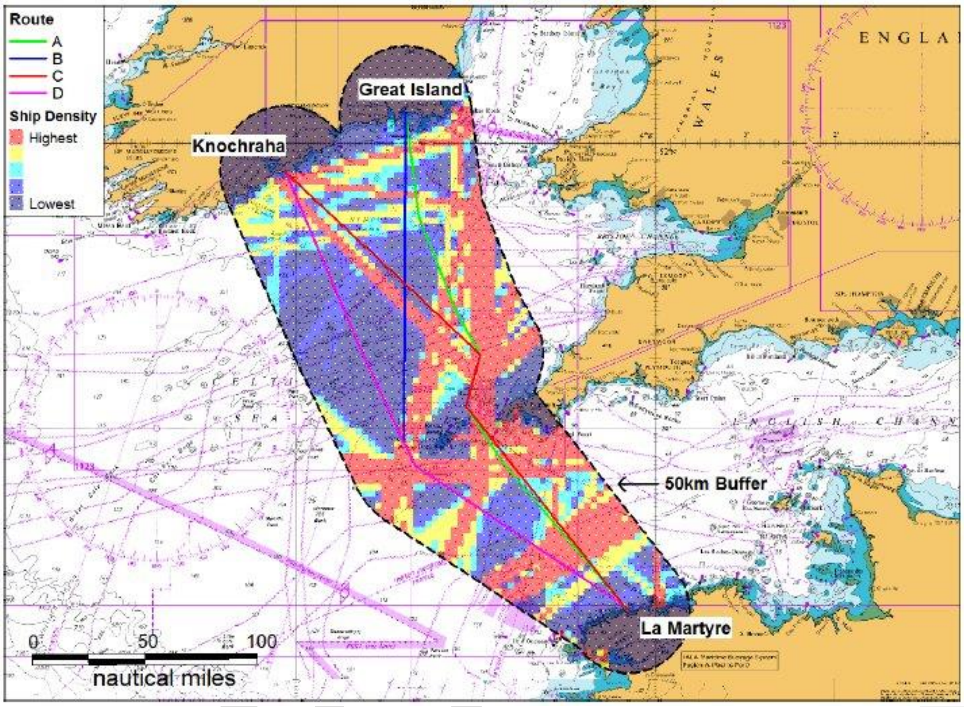
Quantitative data on navigation of small fishing vessels in the vicinity of the cable route is therefore not available, although a general description of activity is available in Volume 4 Environmental Report for UK Offshore - Chapter 20: Commercial Fisheries. However, activity by small vessels in the UK EEZ will be minimal due to the distance from safe havens and use of AIS data is regarded as adequate for the overall assessment.

19.3 Receiving Environment

19.3.1 Vessel traffic

Shipping traffic density for vessels carrying AIS is indicated in Figure 19.1. (Note this is based on the Anatec high-level study report A3225-INT-TN-0 produced in 2013, as this gives a broader picture, but shipping data are entirely consistent with the 2014 and 2015 data presented in Anatec report A3728-RTE-RA-2, dated 2016. Note also that the adopted cable route approximates to option B in these drawings but with a landfall now located at Claycastle Beach, so the adopted route is well within the 50km buffer shown.) This figure shows that the principal concentrations of shipping traffic crossing the overall cable route relate to vessels passing between the Celtic Sea and the English Channel, the Bristol Channel and the Irish Sea (via St George’s Channel). The principal routeings for all of these shipping connections cross the cable route within the UK EEZ or the French EEZ.

Figure 19.1 Marine traffic density along the whole of the proposed cable route (derived from Anatec report A3225-INT-TN-0)



A more detailed breakdown of traffic crossing the proposed cable route by type of vessel, vessel length, vessel draught, vessel deadweight tonnage (dwt) and vessel speed is given in Anatec report A3728-RTE-RA-2, reproduced in Appendix 19B of this ER. The data shows that over the cable route as a whole, 67% of vessels were cargo carrying (including tankers), 17% were fishing vessels, 6% recreational craft (carrying AIS) and the balance comprised a mixture of military, passenger and service vessels. The pattern within the UK EEZ appears from the plots to show a similar balance of uses. Over 25% of vessels were under 50m in length, with longer vessels crossing the cable route in the UK EEZ apparent on routes to the English Channel, including vessels exceeding 200m in length. Similarly, vessel draughts were mainly less than 8m, with 22% recording <5m draught. Deeper-draughted vessels (draught >10m) and vessels with a deadweight of >40,000 were also recorded crossing the cable route, predominantly on routes to and from the English Channel.

Commented [A61]: Appendix to be added into the final application file

19.3.2 Route features

International Maritime Organisation (IMO) routeing measures are in place affecting traffic routeing in the UK EEZ in the form of Traffic Separation Schemes (TSSs). TSSs in Irish waters near Rosslare (TSS off Tuskar Rock) and in UK territorial waters off the south west Wales coast (TSS off Smalls) have a limited effect on routeing within the UK EEZ of vessels passing through St George's Channel between the Irish Sea and the Celtic Sea. Both of these are over 100km from the cable route, towards the east-north-east.

Three TSSs are also in place around the Isles of Scilly, each falling partly within UK territorial waters and partly within the UK EEZ. These are Off Land's End TSS (between the Isles of Scilly and the UK mainland), TSS West of the Isles of Scilly and South of the Isles of Scilly TSS. The latter two affect the detailed pattern of traffic crossing the cable route south west of the Scilly Isles.

There are no offshore energy developments (windfarms, oil and gas platforms) at the water surface within the vicinity of the cable route in the UK EEZ that would affect ship routeing.

The proposed cable route also crosses eleven active subsea cables within the UK EEZ. The crossings may involve additional protection protruding above the seabed but the crossings are in a minimum water depth of approximately 90m, so greatly in excess of the draught of any ship.

19.3.3 Ports

The nearest ports to the section of the cable route within the UK EEZ are small ports in the Isles of Scilly. As is evident from Figure 19.1, these contribute minimal traffic crossing the cable route, as most of their traffic is to and from UK ports. No major ports are near enough to the section of cable route in the UK EEZ to have a significant effect on traffic routeing across the cable.

19.3.4 Anchorages

There are no designated anchorages close to the section of cable route within the UK EEZ and the Anatec study recorded that no anchoring was reported in the vicinity of the cable route in the UK EEZ during the study periods. Anchoring was noted as occurring just outside the study area in the vicinity of the Isles of Scilly, however, the closest occurred more than 20nm from the cable route.

It is worth noting that the AIS data does not provide information on anchoring by recreational vessels; however, these are of less concern in practice as their anchors are unlikely to penetrate to the cable burial depth and, in any case, the anchoring equipment on most recreational vessels has insufficient scope to make anchoring possible in the depths of water present along the cable route in the UK EEZ.

19.4 Characteristics of the Development

A detailed project description, including both installation and operation phases, is detailed in Volume 4 Environmental Report for UK Offshore - Chapter 5: Project Description. This section simply aims to highlight aspects that are particularly relevant to the navigation assessment.

19.4.1 Installation

The cable laying works within the UK EEZ will involve the operation of various vessels, including the following in a worst case scenario:

- Survey vessels (route finalisation, pre-lay survey, post lay survey, post burial survey);

- Vessels for boulder clearance and sandwave pre-sweeping in the UK EEZ, if required;
- Vessels carrying out pre-lay grapnel runs;
- Cable laying and burial vessel or vessels;
- Specialist vessel for rock trenching (potential requirement envisaged over section of cable route in the UK EEZ west of the Isles of Scilly between KP185 and KP305);
- Vessels involved in installation of cable protection (e.g. rock armour); and,
- General supply vessels and rock supply vessel(s) if rock armour is required.

Some of these, for example the cable laying vessel, will be categorized as vessels of restricted manoeuvrability while operating and will require other, non-project related vessels to take appropriate avoidance measures as stipulated in the COLREGS. Vessels may require access to UK harbours, creating a low level of additional coastwise traffic.

Use of primary rock armour protection (i.e. where the cable is not buried at all and protection is entirely by rock armour) is not envisaged within the UK EEZ. However, secondary rock armour protection may be required if the target DOL cannot be achieved despite best endeavours. This is only anticipated in the section west of the Isles of Scilly, where trenching in chalk will be necessary.

The overall schedule for cable lay and burial in UK EEZ excluding weather or mechanical damage stand by is 139 days. A rock placement vessel, if required, will follow cable installation and be required in UK EEZ for between 0 days and approximately 50 days.

19.4.2 Operation

Where the cable is successfully buried to the target depth, the trench will be infilled and the character and bathymetry of the seabed will be unchanged, resulting in no new hazard to passing vessels. Where secondary rock armour is required, this may protrude up to a maximum of 2m above the seabed resulting in a reduction in available depth.

19.4.3 Potential effects on navigation

Principal characteristics of the development in relation to potential effects on navigation are:

- Temporary presence of work vessels with limited ability to manoeuvre during the construction phase and potentially an associated temporary advisory safety zone around installation vessels, requesting avoidance by passing vessels;
- Presence of rock armour above the previous seabed level, resulting in localised reduction in water depth available for navigation; and
- Presence of cables within anchor burial depth of the seabed, imposing restrictions on where vessels may anchor.

19.5 Likely Significant Impacts of the Development

19.5.1 Do Nothing

Without the implementation of the Celtic Interconnector Project, shipping within the UK EEZ would continue to show largely the same pattern as at present, although there may be a slight shift to greater use of the deep-water routes as vessels become larger. In particular, growth of traffic at the recently built Riverside Quay in Liverpool, which allows larger container ships to access the port, will result in passage of deeper draught ships through the northern part of the cable route lying within the UK EEZ.

19.5.2 Construction Phase

Potential effects during construction are:

- Obstruction of normal navigation by vessels involved in cable installation activity.

The cable installation process will involve one or more vessels classed as restricted in their ability to manoeuvre while cable laying or operating other underwater equipment. As required by the COLREGS, these vessels will display appropriate lights and shapes to indicate this status and, in restricted visibility, emit the required sound signals. Other vessels will have a duty to keep out of the way. It may be that an advisory safety zone will be established, by the contractor requesting avoidance of work vessels by a minimum specified distance. As the cable laying progresses the area affected will move, but at any one time it will be a small area (depending on any advisory safety zone) and the obstruction will not be situated at any time in a narrow channel or fairway. Thus avoidance of such vessels will cause minimal interference or delay to passing vessels, particularly if they are advised in advance and can adjust their course in good time.

Compliance with the COLREGS by all vessels, including both those involved in the Celtic Interconnector project and those passing through the area, should be sufficient to ensure vessel safety. However, further steps will be taken by EirGrid and RTE to ensure that mariners are warned in advance of the presence of the cable laying operations, including circulation of information via Notices to Mariners and radio navigational warnings, in advance of and during the works, allowing advance passage planning, thereby reducing disruption to routeing and risk of inappropriate interaction. It is proposed to make direct contact with local commercial fishing interests once the precise nature and timing of the cable installation activities has been determined, in order to that ensure all local sea users are fully informed and thus risks to navigation are minimized as far as practicable.

No restrictions on navigation are anticipated once the Celtic Interconnector is operational.

On the basis that adequate information will be promulgated to mariners, the short duration of the works, and the reasonable expectation that mariners are familiar with and comply with the COLREGS, the adverse effects of cable installation operations on existing navigation activity in the vicinity are assessed as minor and not significant. (It is noted again that effects on commercial fishing itself are not considered here but in Volume 4 Environmental Report for UK Offshore - Chapter 20: Commercial Fisheries.

19.5.3 Operational Phase

Potential effects during operation are:

- Grounding or damage to stern gear where rock armour is present; and,
- Restriction of anchoring in vicinity of cable reducing the scope for anchoring.

As the whole of the cable route within the UK EEZ is in water depths exceeding 90m, the presence of the cable will present no risk of grounding; therefore, the adverse effects are assessed as negligible and not significant.

The cable route within the UK EEZ does not pass through or near to any designated anchorage areas and AIS data examined have not identified any instances of ships anchoring close to this section of the cable route. Thus the effects of the presence of the cable on availability of anchorages or ability to anchor are assessed as negligible and not significant.

19.5.4 Decommissioning Phase

A decommissioning plan will be prepared prior to the decommissioning phase of the proposed development, which is expected to be at least 40 years from the start of operation. It is currently anticipated that the cable and associated external cable protection will be left in-situ where this is deemed environmentally acceptable; this may require a level of long-term monitoring and maintenance. There are not expected to be any effects on shipping and navigation as a result of this proposed course of action. However, any works required for decommissioning will be subject to future consent applications, and environmental assessments, as relevant.

19.5.5 Cumulative Effects

No other projects have been identified involving construction activity or new seabed installations in the vicinity in the cable route within the UK EEZ, so no potential cumulative effects are predicted.

19.5.6 Transboundary effects

Although much shipping is transboundary in nature, effects of the cable on navigation during both installation and operational phases have been shown to be:

- Local to the installation of the cable and associated maintenance activities within waters under UK jurisdiction; and
- Not significant.

No significant effects have been identified in the UK EEZ which would result in transfer of marine traffic from the UK EEZ to those of another state (e.g. Ireland or France) or an increase in hazards to shipping in another state. Transboundary effects are therefore determined to be negligible.

19.6 Mitigation and Monitoring Measures

Commented [A62]: Placeholder: All mitigation measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

19.6.1 Construction Phase

During the construction phase, the key to vessel safety is compliance by both work and passing vessels with the COLREGS. This will be encouraged and facilitated by keeping all sea users fully informed of plans and progress regarding the cable installation and procedures in place to ensure their safety when navigating in the vicinity. This will be achieved through:

- The issuing of Notices to Mariners;
- Radio navigational warnings by local ports and coastguards;
- Placing news items on the Kingfisher Information Service Offshore Renewables and Cable Awareness (KIS-ORCA) website;
- Radio communication between work vessels and passing vessels; and
- Direct contact with local commercial fishing organisations.

It is recommended that the cable contractor monitors and maintains records of radio communications with passing craft and reviews these at intervals to ascertain whether any changes or improvements to information dissemination would be appropriate.

19.6.2 Operational Phase

The principal measure to minimize risks of adverse interaction between vessels and the cable is to ensure that information is supplied to appropriate authorities to enable marine charts and sailing directions to be updated to show the cable route. This will include ensuring that the location of the cable is included on the KIS-ORCA website.

19.6.3 Residual Impacts

No residual significant effects have been identified.

19.7 References

Anatec, 2013. Ireland to France Cable Route. Shipping and Navigational Features. High Level Review (Technical Note). Ref. no. A3225-INT-TN-0. December 2013. Prepared for Intertek.

Anatec, 2016. Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Ref. no. A3728-RTE-RA-2, Rev. 4. April 2016. Report prepared for EirGrid and RTE (Appendix 19B to the ER).

Anatec. 2016. Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Appendix A – Data validation. Ref. no. A3728-RTE-AP-1, Rev. 1. January 2016. Report prepared for EirGrid and RTE.

Anatec. 2016. Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Appendix B – VMS Fishing analysis. Ref. no. A3728-RTE-AP-2, Rev. 1. January 2016. Report prepared for EirGrid and RTE.

International Maritime Organization, 1972. International Regulations for Preventing Collision at Sea 1972.

Merchant Shipping (Distress Signals and Prevention of Collisions) Regulations 1996 (S.I. 1996:75).

Merchant Shipping (Vessel Traffic Monitoring and Reporting Requirements) Regulations 2004 (S.I. 2004:2110) (as amended).

United Kingdom Hydrographic Office, 2019. Admiralty Sailing Directions, Irish Coast Pilot, NP40. 21st Edition.

United Kingdom Hydrographic Office, 2011. Admiralty Sailing Directions, Channel Pilot, NP27. 9th Edition.

United Kingdom Hydrographic Office, 2012. UK Admiralty Chart 1123 – Western approaches to St George's Channel and Bristol Channel.

United Kingdom Hydrographic Office, 1991. UK Admiralty Chart 2649 – Western approaches to the English Channel.

United Nations, 1982. United Nations Convention on the Law of the Sea 1982.

Wood, 2019. CELTIC Interconnector Study Synthesis. Report for EirGrid & RTE. Doc Ref: 400584-PL-REP-001, Rev: H. July 2019.

20 Commercial Fisheries

20.1 Introduction

This chapter of the Environmental Report (ER) assesses the likely significant effects that the installation and operation of the proposed marine cable may have on commercial fisheries. It considers the potential impacts and identifies appropriate mitigation measures to avoid, reduce, or offset potential adverse impacts.

The commercial fisheries chapter should be read in conjunction with the development description provided in Volume 4 Environmental Report for UK Offshore Chapter 5: Project Description and where there is an overlap or relationship between the assessments of effects namely Volume 4 Environmental Report for UK Offshore:

- Chapter 11: Marine Sediment Quality;
- Chapter 12: Marine Physical Processes;
- Chapter 14: Biodiversity;
- Chapter 18: Noise and Vibration; and
- Chapter 19: Shipping and Navigation.

20.2 Data Sources

The primary data sources used in the assessment of impacts on commercial fisheries include the following:

Project-specific studies undertaken with regards to vessel activity along the proposed route of the Celtic Interconnector that include:

- Celtic Interconnector Study Synthesis. Prepared by Wood Group for EirGrid & RTE. Doc Ref: 400584-PL-REP-001, Rev: H. July 2019;
- Celtic Interconnector Project. Fishing Activity Report. November 2013. Report for EirGrid and RTE by NetWork Services;
- Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Ref. no. A3728-RTE-RA-2, Rev. 4. April 2016. Report prepared for EirGrid and RTE by Anatec Limited; and
- Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Appendix B – VMS Fishing analysis. Ref. no. A3728-RTE-AP-2, Rev. 1. January 2016. Report prepared for EirGrid and RTE by Anatec Limited.

These reports provide information on fishing activity within the UK Exclusive Economic Zone (EEZ).

In addition to the above, a review of both peer-reviewed and grey literature was undertaken. Key reports and data sources have included:

- International Council for the Exploration of the Seas (ICES) - ICES eco system data portal (https://ecosystemdata.ices.dk/);
- Marine Management Organisation (MMO) - United Kingdom commercial sea fisheries landings by EEZ of capture: 2012 – 2018;
- MMO - Landings data by Exclusive Economic Zone for all UK registered vessels 2016;
- MMO - Landings data by Exclusive Economic Zone for all UK registered vessels 2012-18; and
- MMO – UK Sea Fisheries Statistics 2016.

20.3 Commercial Fisheries Assessment Overview

The potential impacts of the installation and operation of the proposed marine cable on commercial fisheries interests have been assessed, using the methodology broadly described in Sections 20.3.1 to 20.3.2. In order to assess the overall significance of an impact it was necessary to establish:

- The receptors that could be affected by the proposed development;
- Possible impacts arising from renewable energy or other projects on commercial fisheries;
- The magnitude of the potential impact incorporating likelihood, level of change, geographic extent, and duration; and
- The sensitivity and/or importance of the receiving environment or receptor.

20.3.1 Identification of Receptors

The following key receptors were identified by Richards (2013) for commercial fisheries:

- Static gear (pots, lines, and gill nets) – trawlers from Ireland, France, and Spain;
- Demersal (bottom) trawl gear – trawlers from Ireland, UK, Belgium, France, and Spain; and
- Pelagic (mid-water) trawl gear – trawlers from Ireland and UK.
- Other trawlers from Germany, Russia, and Netherlands are also known to be active in the Celtic Sea and within areas where the marine cable route is proposed. The distribution of International fishing effort in the UK EEZ (CEL1 Regime) is presented in Section 20.5, Figure 20.3.

20.3.2 Impact Magnitude

The impact magnitude considers the scale of the predicted change to baseline conditions resulting from a given potential impact, and takes into account the likelihood of the impact occurring, the spatial extent over which it occurs, the level of change with respect to baseline conditions, and the duration of the impact prior to recovery.

The magnitude of change affecting a receptor is identified on a scale ranging from ‘neutral’ to ‘high’. The criteria for describing impact magnitude are described in Table 20..

Table 20.1 Definition of Terms Relating to the Impact Magnitude

Potential consequence of impact on VER	Magnitude
Commercial fishing activity on traditional fishing grounds will be severely affected by the Project and/or associated construction activities. Permanent (greater than three years) interference the fishing grounds will occur.	**High**
Commercial fishing activity on traditional fishing grounds will be significantly affected by the Project and/or associated construction activities. Long term (six months to three years) interference to fishing grounds will occur.	**Medium**
Commercial fishing activity on traditional fishing grounds will be affected by the Project and/or associated construction activities. Medium term (one to six months) interference the fishing grounds will occur.	**Low**
Commercial fishing activity on traditional fishing grounds will remain largely unaffected by the Project and/or associated construction activity. Intermittent and temporary (less than one month) interference to fishing grounds will occur.	**Negligible**
Although it is not always possible to state categorically that there will be no impact on a receptor the term neutral will be used where the level of exposure is considered to be analogous to natural variation.	**Neutral**

20.3.3 Sensitivity or Importance of Receptor

The sensitivity of the baseline conditions has been assessed according to the relative importance of existing fisheries interests, on or near, the proposed marine cable route (eg whether it is of international, national, regional, local or negligible importance), or by the sensitivity of receptors, which would potentially be affected by marine cable installation and operation.

The sensitivity of commercial fisheries has been assessed in accordance with the criteria outlined in Table 20.2.

Table 20.2 Definition of Terms Relating to the Sensitivity of the Receptor

Sensitivity	Description
Very High	The receptor has little or no capacity to absorb change without fundamentally altering its present character, is of very high fisheries interest, or of international importance.
High	The receptor has low capacity to absorb change without fundamentally altering its present character, has high fisheries interest, or is of national importance.

Sensitivity	**Description**
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, has moderate fisheries interest, or is of regional importance.
Low	The receptor is tolerant of change without detriment to its character, is low fisheries interest, or local importance.
Negligible	The receptor is resistant to change and/or is of little fisheries interest.

20.3.4 Determination of Impact Significance

A qualitative approach has been taken to determining the significance of the potential impacts to commercial fisheries, broadly following the approach illustrated in Table 20.3, and also using professional judgement. The significance of a given impact is based on a combination of the magnitude (Table 20.1) of a potential impact and the sensitivity or importance of the receptor (Table 20.2). Impacts are identified as ranging between Negligible to Substantial.

Table 20.3 Matrix Used for Assessment Impact Significance

		Magnitude of Impact				
		No Change	**Negligible**	**Low**	**Medium**	**High**
Sensitivity of Receptor	**Negligible**	Negligible	Negligible	Negligible or minor	Negligible or minor	Minor
	Low	Negligible	Negligible or minor	Negligible or minor	Minor	Minor or moderate
	Medium	Negligible	Negligible or minor	Minor	Moderate	Moderate or major
	High	Negligible	Minor	Minor or moderate	Moderate or major	Major or substantial
	Very high	Negligible	Minor	Moderate or major	Major or substantial	Substantial

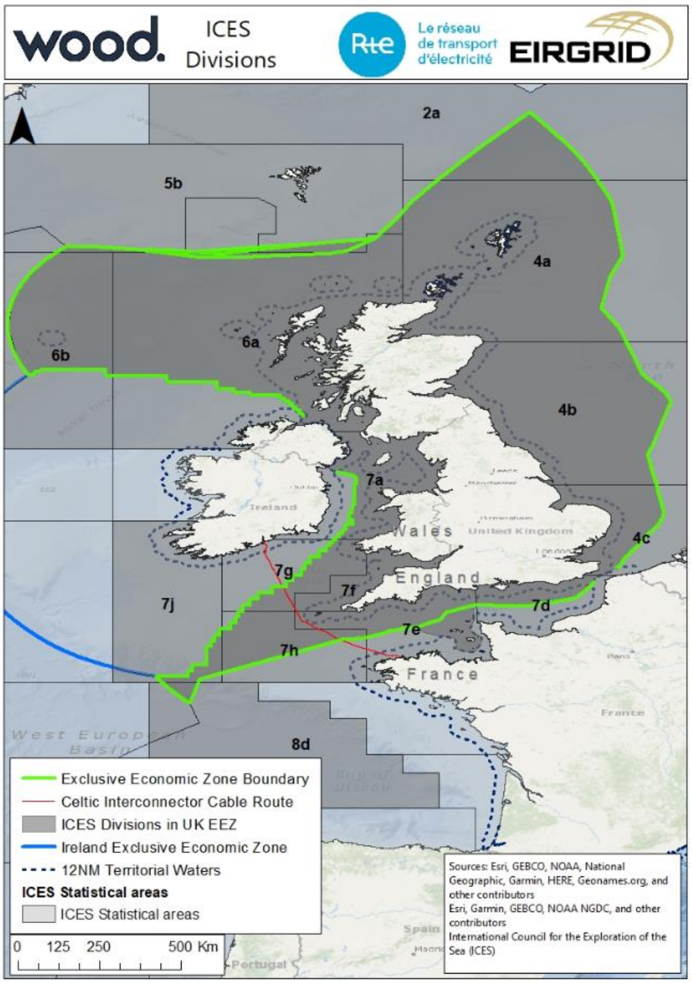
The results of this impact assessment are presented as residual impacts in Table 20.3. Residual impacts take into account and design mitigation has been incorporated into the marine cable route design. The design mitigation will also be implemented during installation and operation.

20.4 Commercial Fisheries Baseline Characterisation

The geographic scope of the appraisal includes the area along and adjacent to the marine cable route, as illustrated in Figure 20.1.

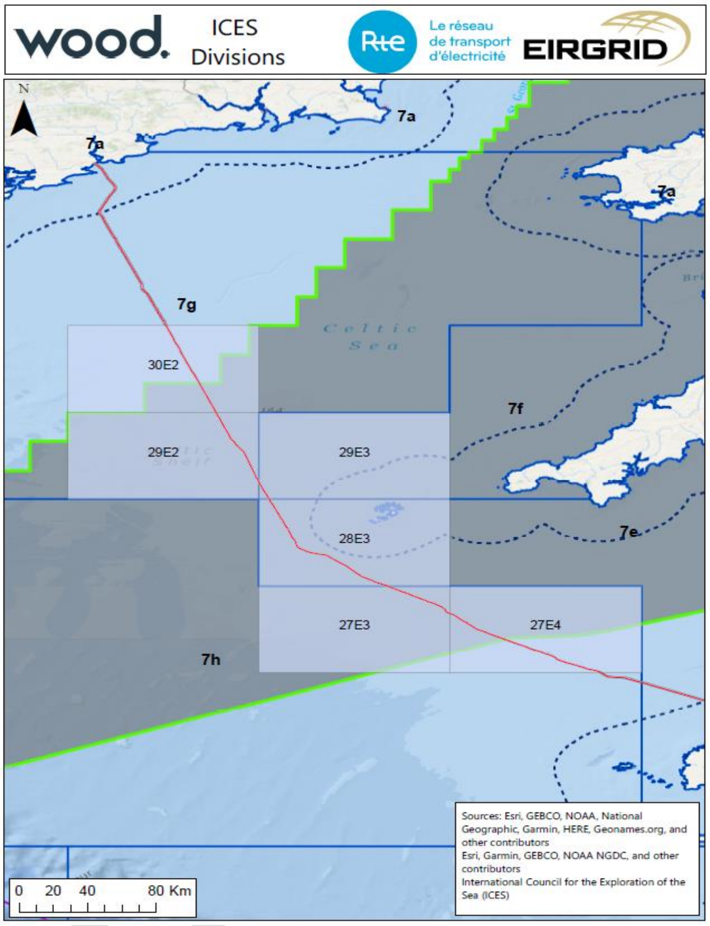
The overview covers commercial fishing interests along the length of the marine cable route within the UK EEZ. The marine cable route within the UK EEZ is approximately 211km long. It passes approximately 30km to the west of the Isles of Scilly and approximately 75km to the west of Land's End on the UK mainland. The marine cable route does not enter the Territorial Waters of the UK. The marine cable route runs through four ICES Divisions in the UK EEZ, including 7g, 7f, 7e and 7h, as depicted in Figure 20.1.

Figure 20.1 UK EEZ, Marine Cable Route and Associated ICES Divisions



The ICES Divisions and Sub-divisions are used to geo-reference the boundaries of fish stocks and fisheries management areas. The ICES Sub-divisions and (Divisions) in the Project area, include 30E2, 29E2 (7g), 29E3 (7f), 28E3 (7e), 27E3 and 27E4 (7h), as depicted in Figure 20.2.

Figure 20.2 UK EEZ, Marine Cable Route and Associated ICES Sub-divisions

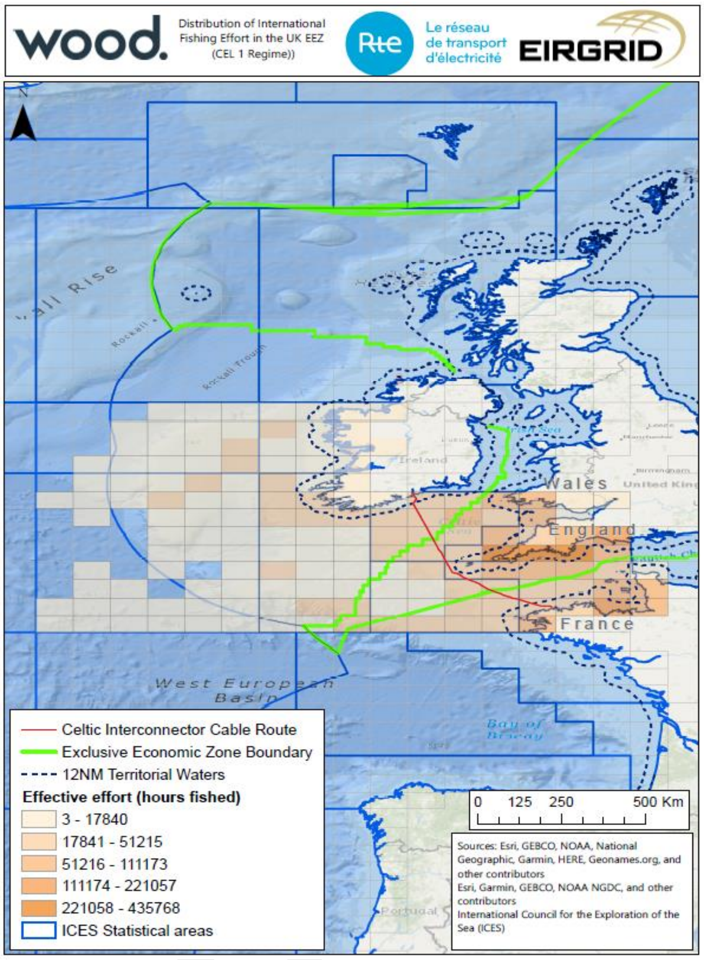


20.5 Fishing Areas and International Fishing Effort

Richards (2013) indicates that the marine cable route transits numerous fishing areas in the Celtic Sea, Southwest Approaches, and western English Channel. Richards (2013) indicates that these areas are constantly fished by vessels from the following countries:

- **Ireland** - offshore demersal (bottom), pelagic (mid-water) and static gear (targeting shellfish with pots and traps and whitefish with gill nets and long lines) in offshore waters;
- **UK** - offshore demersal (bottom) and pelagic (mid-water) in offshore waters;
- **Belgium** - offshore demersal (bottom);
- **France** - offshore demersal (bottom) and static gear (targeting shellfish with pots and traps and whitefish with gill nets and long lines) in offshore waters; and
- **Spain** - offshore demersal (bottom) and static gear (targeting shellfish with pots and traps and whitefish with gill nets and long lines) in offshore waters.
- The distribution of International fishing effort in the UK EEZ (CEL1 Regime) is illustrated in Figure 20.3. This comes from the EU's Joint Research Centre (JRC) and their fisheries dependent information (FID) (2017 Edition). The countries/vessels that are included in this data source are Belgium, Germany, England, Spain, France, Russia, Ireland, Northern Ireland, Netherlands, and Scotland.

Figure 20.3 Distribution of International Fishing Effort in the UK EEZ (CEL 1 Regime))[18]



20.6 Fishing Gear Methods

The use of various fishing gears reflects the distribution of target species, regulations, and bottom characteristics. A comprehensive description of fishing methods is provided by Richards (2013), however a summary of the key methods employed within the UK EEZ are provided below.

[18] European Commission's Joint Research Centre (JRC) - Fisheries Dependent Information (2017 Edition) https://stecf.jrc.ec.europa.eu/dd/effort/graphs-quarter

There are three main categories of fishing gear fished within the waters adjacent to the proposed cable route:

- Static gear (pots, lines and gill nets);
- Demersal (bottom) trawl gear; and
- Pelagic (mid-water) trawl gear.

20.6.1 Static Gear

Static gear comprising gill nets, traps and pots set in a fixed location and periodically serviced. These methods are designed to intercept fish or to attract fish by bait, that consequently become caught in the gear.

Gill nets comprise a panel of netting suspended vertically in the water by floats along the head rope and a weighted lead line or footrope. Panels are stitched together to create nets that can extend for several kilometres in length. Fish unable to detect the net swim into it and become entangled, often by their gill cover. There are two main types of gillnets in use: bottom gillnets and mid-water gillnets, the fisheries typically target cod, hake, sole and monkfish.

Pots or traps comprise baited pots often connected by a common line that can extended for many hundreds of metres. Once set, pots can be left on the seabed for several days before recovery. Pots can be deployed at a variety of depths from close in shore to many hundreds of metres in depth. Potting for crab is carried out in inshore waters over sandy ground. Prawns are targeted on the muddy, clay grounds along the coast and out to around 6nm offshore.

Static gear is not considered to pose a significant risk to subsea cables. However, disruption can be caused to static gear fisheries during the construction phase, as a result of exclusion in the short-term via a controlled safety zone, resulting in displacement of excluded vessels to other fishing grounds. This may result in a short-term increase in steaming times and associated fuel costs and additional time spent at sea. Following the construction period, static gear fishing can resume in the vicinity of the marine cable route, as required.

Static gear fishing is carried out in the inshore waters around the UK coast. This mostly involves potting for lobster on the hard, rocky grounds and potting for crab on sandy ground and for prawns on the muddy, clay grounds out and along the coast to around 6nm offshore (Richards, 2013).

Anatec (2016) reports notable AIS tracks for static gear (pots and traps) and gill netters within the marine cable route study area. Static gear tracks are distributed to the north west and south west of the Isle of Scilly, and to the south east of the study area (see section 20.8, Figure 20.4). The applicable ICES Sub-divisions from Figure 20.2 include 29E3, 28E3 and 27E4.

Gill netter tracks are distributed immediately to the south west of the Isle of Scilly and to the south east of the study area (see section 20.9, Figure 20.4). The applicable ICES Sub-divisions from Figure 20.2 include 28E3, 27E3 and 27E4.

20.7 Demersal (Bottom) Trawl

20.7.1 Otterboard Trawls

Otterboard trawls consist of a cone-shaped net or trawl with a wide mouth narrowing to the ‘cod-end’. The net is towed through the water typically along, or close to the seabed, targeting *Nephrops*, and gadoids. The mouth of the net is kept open by the force of water acting against two ‘otter boards’, constructed of either steel or wood and attached to each side of the net by a bridle which draws the mouth of the net open. The top of the net is buoyed up by floats attached to the headline. The bottom of the mouth of the net is weighted down by a wire, or footrope fitted with round rubber, or steel rockhopper discs to enable it to ride over the seabed contours. The otter boards can penetrate soft sediments to around 0.3m. Two vessels may tow one net between them, known as pair trawling.

Richards (2013) cites research (unreferenced) with regard to trawl board penetration indicating subsea cables buried to a depth greater than 0.3m should be safe from trawl board damage. The author indicates that most of the demersal otterboard trawlers operating in the Celtic Sea now use demersal twin-rig trawl gear.

In the same report the author does not consider pair trawling to pose significant risk to surface laid or lightly buried subsea cables. However, large shackles and ground gear associated with demersal trawls have the potential to foul submarine cables in suspension and unburied cables. As reported, heavy bridle and ground gear towed repeatedly along or over marine cables have the potential to score and/or damage cables (Richards 2013).

Anatec (2016) reports significant AIS tracks for demersal trawlers within the marine cable route study area. These tracks are distributed from the north of the study area, to the south west of the Isle of Scilly, and to the south east of the study area (see section 20.9, Figure 20.4). This is applicable to all of the ICES Sub-divisions from Figure 20.2 and particularly 30E2 to 28E3.

20.7.2 Beam Trawls

In its simplest form a beam trawl is a conical net suspended below a metal or wooden beam with steel ‘shoes’ supporting the beam at either end. Small inshore vessels typically operate with a single lightweight steel beam rig, whilst larger offshore vessel may tow two larger beam trawl rigs, one either side of the vessel.

The trawls are typically either a stone mat gear type, or open gear type. Stone mat beam trawls have a chain mesh strung in front of the footrope to prevent rocks rolling into the net. The weight of the chain mesh causes the trawl to fish very hard on the bed.

Open beam gear is generally used on clear ground and replaces the chain mesh with a number of loops of chain, known as ‘tickler’ chains, used to increase the gear's catch efficiency. Beam trawlers operating with open beam gear will often tow the gear at speeds in excess of 6 knots through the water when fishing for sole.

Most of the beam trawlers that operate in the vicinity of the proposed cable use the heavy stone mat beam gear. UK, Belgian and Irish beam trawlers regularly fish the Celtic Sea and

Southwest grounds for high-value fish species such as dover (black) sole, monk fish and megrim sole (Richards, 2013).

Beam trawls have the potential to foul subsea cables with a burial depth of 0.3m, or less, due to the design of the supporting steel shoes at either end of the beam. Beam shoes can be fitted with steel cable guards, or rubber wheels, that can reduce the risk of cables being hooked by the leading edge of the steel beam shoe, making the gear more cable friendly although not removing the risk (Richards, 2013).

Anatec (2016) reports significant AIS tracks for beam trawlers within the marine cable route study area. These tracks are distributed to the north of the study area, to the north west, south west and south of the Isle of Scilly, and onto the south east of the study area (see section 20.9, Figure 20.4). This is applicable to all of the ICES Sub-divisions from Figure 20.2 and particularly 28E3 to 27E4.

20.7.3 Sumwing Beam

The Sumwing beam replaces the heavy steel beam of a beam trawler with a hydrofoil wing, which is designed to fish just off the seabed at the same height as the conventional beam (c. 1m) without the use of the heavy steel beam shoes required to suspend the beam. Richards (2013) indicates that this type of gear has been employed by the Belgian fleet in the Celtic Sea grounds. This gear has can fish over softer ground however although the Sumwing beam itself “swims” just above the sea floor, it has a protruding stabilising “snout” that makes bottom contact, and this snout has the potential to foul an unburied subsea cable or a cable in suspension.

Anatec (2016) did not report anything specific for this particular method within the study area.

20.7.4 Scallop Dredges

Dredges are towed behind a vessel and can be up to 4.5-5m wide and weigh as much as 1 tonne. The dredge commonly consists of a large metal frame with metal bags to hold the catch. Steel teeth protrude some 12cm at the mouth of the dredge and these teeth penetrate the seabed to sift out the scallops. The teeth are spring-loaded and tensioned according to ground conditions to allow teeth to ride over hard and rocky ground. The frame and cutting bar ride along the surface of the seabed, while the bag drags along behind. A tickler chain fitted to the front of the frame triggers organisms such as scallops to propel from the seabed, so they are more easily captured. Rock chains are used on rocky areas of seafloor to prevent large boulders from entering the bag.

Scallop dredging is likely to cause damage, or foul, an unburied marine cable, or where a cable is buried to a depth of 0.3m, or less.

A variation to the conventional spring-loaded dredge is the N-Viro dredge, that replaces the spring-loaded tooth bar, with a rigid tooth bar with sprung steel tines. The N-Viro dredge is less likely than the spring-loaded dredge to foul and damage an unburied marine cable.

Richards (2013) reported that most of the Irish beam trawler fleet that is based in Kilmore Quay, south east Ireland, carry out most of the scallop dredging and majority of the fishing activity takes place on the Nymphe Bank grounds, which are c.50km to the west of the marine cable route.

Anatec (2016) reports a few AIS tracks for dredgers within the marine cable route study area. These tracks are distributed to the north of the study area, to the north west, south west and south of the Isle of Scilly, and onto the south east of the study area (see section 20.9, Figure 20.4). The applicable ICES Sub-divisions from Figure 20.2 include 30E2 and 29E2.

20.7.5 Scottish Style Fly Seine Netting

This method uses a net similar to a demersal trawl, which is set over the seabed using two long ropes connected to the vessel. The net is trawled across the seabed by means of winching. During this activity the vessel is almost stationary as the speed is controlled by the winching operation. No boards or heavy metal components are used with this method of fishing and it is usually carried out on soft ground. Richards (2013) does not consider this method to pose any significant risk to a marine cable.

The author also indicated that a number of seiner/trawlers are based in Southern Ireland and, in recent years, a number of the larger French trawlers have been converted into fly seiners, and that these vessels will sometimes fish in the vicinity of the marine cable route, in the Celtic Sea, Southwest Approaches and western English Channel.

20.8 Pelagic (Mid-Water) Trawl

Pelagic trawl gear is fished mid-water targeting shoaling fish such as mackerel, herring and sprat. The gear seldom contacts the seabed and is considered unlikely to represent any significant risk to subsea cables during normal fishing operations.

Anatec (2016) report a few AIS tracks for pelagic trawlers within the marine cable route. These tracks are distributed to the north of the study area (see section 20.9, Figure 20.4). The applicable ICES Sub-divisions from Figure 20.2 include 30E2 and 29E2.

20.9 Fishing Activity

Automatic Identification System (AIS) and Vessel Monitoring Systems (VMS) data collected via both satellite and terrestrial receivers was used to provide an overview of fishing activity of vessel >15m within the study area (Anatec, 2016).

AIS is an automatic tracking system that provides a vessels identification, position, course, and speed to both authorities and other vessels allowing the vessel movements to be tracked and monitored. AIS is required by the International Maritime Organization's International Convention for the Safety of Life at Sea to be carried by all large vessels. VMS relates specifically to commercial fishing vessels and allows the regulatory authorities to track and monitor the activities of fishing vessels within the UK EEZ.

Data analysed by Anatec (2016) covered fishing vessels >15m in length. Whilst a proportion of smaller vessels may carry AIS voluntarily they are not obliged to broadcast and therefore it is assumed they are not covered within this analysis.

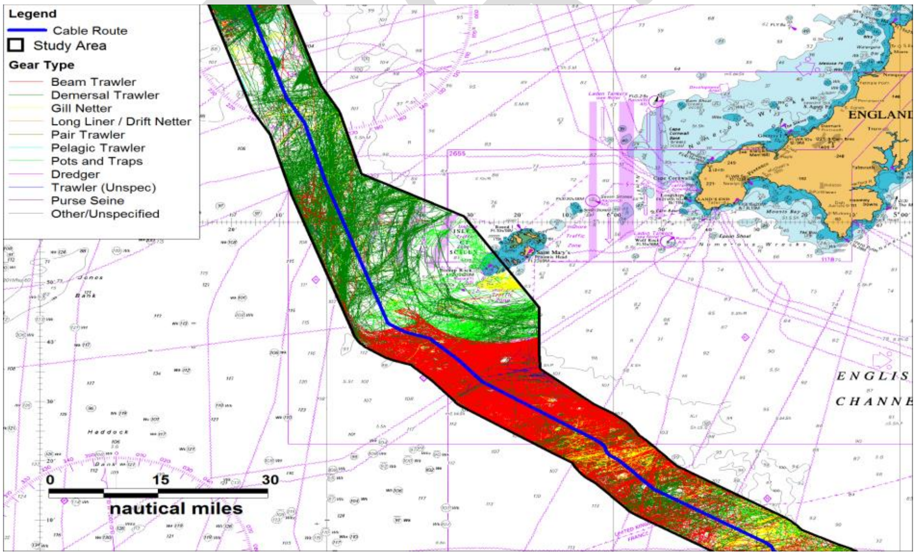
Survey data for both AIS and VMS (Anatec, 2016) was available for the following periods:

- AIS:
    - 1 April to 30 September 2014; and
    - 1 May to 31 October 2015.
- VMS:
    - January to December 2009.

Whilst it is recognised that there is a time difference between the observations of fishing activity and the current assessment, and that fishing activity can be dynamic in nature due to changes in productivity of fishing grounds, quota allocations, legislation, economic constraints and other restrictions, the analysis does provide an overview of the fisheries during the period of time for which data was available. It is noted in the report that although there is a time difference of 5 to 6 years between the AIS and VMS datasets the values agree reasonably well suggesting a degree of stability within the fishery.

The analysis assumed vessels travelling >6 knots was likely to be steaming on passage between ports and/or fishing grounds. Fishing vessels travelling <6 knots were assumed to be actively fishing (this is a conservative assumption as these vessels could also be steaming. The tracks of fishing vessels actively fishing within the UK EEZ, and along the marine cable route study area, are presented in Figure 20.4.

Figure 20.4 AIS Tracks Less than 6 Knots, 12 Months (2014/2015) – UK EEZ

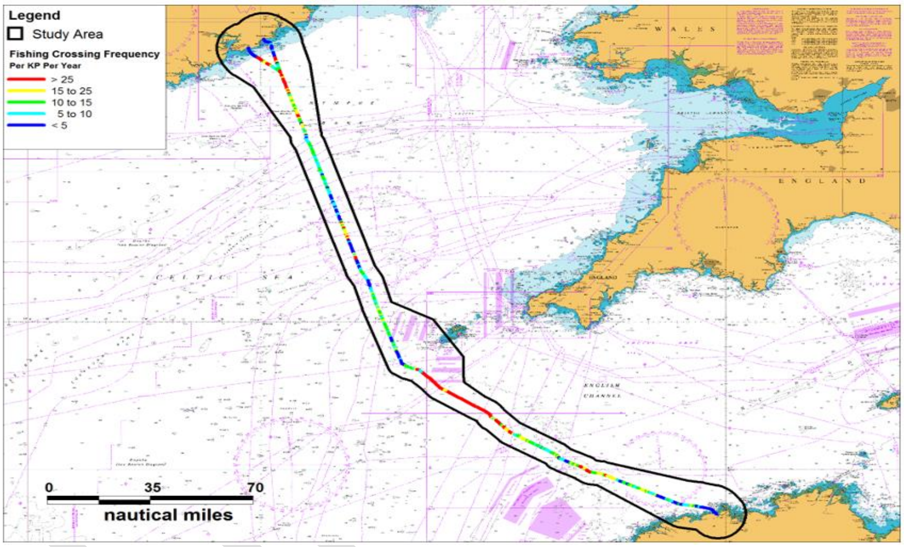


Demersal and beam trawlers account for the majority of fishing effort along the marine cable route study area, within the UK EEZ, followed by gill netters, static (pots and traps), long liner/drift netters and pelagic trawlers. Both demersal and beam trawlers trawl along the seabed and could therefore interact with the cable route (Anatec 2016).

20.10 Fishing Vessel Crossings

Analysis of the total number of vessels travelling below 6 knots crossing the proposed cable route was used to identify sections of the cable route considered to be high risk from fishing vessels (Anatec 2016). The distribution of the annual number of fishing-cable crossings per kilometre point (KP) of marine cable is presented in Figure 20.5.

Figure 20.5 Annual Fishing Crossing Frequency Results per KP of Marine Cable Route (Anatec, 2016)

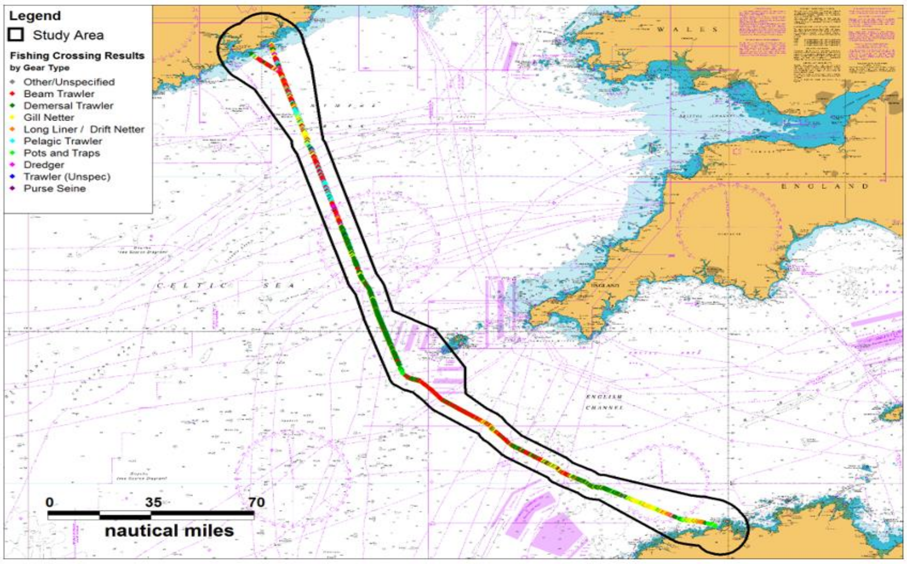


This shows that sections of the marine cable route study area to north west and south of the Scilly Isles are considered to be high-risk areas for fishing vessel crossings. The applicable ICES Sub-divisions from Figure 20.2 include 29E2, 28E3, 27E3 and 27E4.

20.11 Fishing Vessel Crossings (Per Gear Type)

Figure 20.6 presents a plot of all fishing-cable crossings for vessels travelling at less than 6 knots, colour-coded by fishing vessel gear type (Anatec, 2016).

Figure 20.6 Annual Fishing Crossing Results by Gear Type (Anatec, 2016)



This shows that the majority of fishing vessel crossings, within marine cable route study area, were by demersal trawlers, beam trawlers, gill netters, static (pots and traps) and pelagic trawlers. Also, that there is crossover with the high-risk areas that were identified in Figure 20.5 and the associated ICES Sub-divisions from Figure 20.2.

20.12 Target Species for the Commercial Fisheries in the UK EEZ

20.12.1 Demersal Fish

Demersal fish are those species that live on or close to the seabed. The key species are primarily targeted within mixed fisheries by trawls (otterboard and beam). Demersal trawls have the potential to foul a cable in suspension, an unburied marine cable, or where a marine cable is buried to a depth of 0.3m or less (see section 20.7.1). The fisheries along the proposed cable route, and specifically ICES divisions 7g, 7f, 7e and 7h (as depicted in Figure 20.1), comprise the following key species.

These target species have been identified from the MMO - Landings data by Exclusive Economic Zone for all UK registered vessels (2012-2018). These data include vessels from England, Guernsey, Isle of Man, Jersey, Northern Ireland, Scotland, and Wales.

More specifically, and for the purposed of this report, the most recent/available data for 2018 has been used, and value thresholds have been incorporated to determine importance (notable = value (£) entries >£200k for demersal, >£200k for crustaceans/molluscs and >£100k for pelagic).

Monk or Angler Fish (Lophius piscatorius)

Monk or Angler fish are marine and bathydemersal with a depth range of 20-1000m. The species occurs on sandy and muddy bottoms from the coast down to depths of 1,000m, and m ay also be found on rocky bottoms. Their capture in 2018, and notably within the ICES divisions 7e, and 7h, was via beam trawls and demersal trawls. Across 7e and 7h the total weight of monk or angler fish landed was over 1,470 (tonnes) and the total value was over £4.9 million.

Common Sole (Solea solea)

Common sole are marine/brackish, demersal and oceanodromous with a depth range of 0-150m. They burrow into sandy and muddy bottoms and retreat to deeper water during the winter. Their capture in 2018, and notably within the ICES divisions 7e, 7g and 7f was via beam trawls, and gill nets and entangling nets. Across 7e, 7g and 7f the total weight of common sole landed was over 973 (tonnes) and the total value was over £4.5 million.

European Plaice (Pleuronectes platessa)

European plaice are marine, brackish, demersal and oceanodromous with a depth range of 0-200m. Adults live on mixed bottoms, the older the deeper the occurrence; small individuals are usually seen on bathing beaches. Occurs on mud and sand bottom from a few meters down to about 100 m, at sea, estuaries and rarely entering freshwaters. Their capture in 2018, and notably within the ICES division 7e, was via beam trawls and demersal trawls. Across 7e the total weight of European plaice landed was over 1,364 (tonnes) and the total value was over £3 million.

Turbot (Scophthalmus maximus)

Turbot are marine, brackish, demersal and oceanodromous with a depth range of 20-70m. Adults live on sandy, rocky or mixed bottoms; rather common in brackish waters. Their capture in 2018, and notably within the ICES division 7e, was via beam trawls. Across 7e the total weight of turbot landed was over 246 (tonnes) and the total value was over £2.8 million.

European Sea Bass (Dicentrarchus labrax)

European sea bass are marine/freshwater/brackish, demersal and oceanodromous with a depth range of 10-100m, with adults manifesting demersal behaviour. They inhabit coastal waters down to about 100 m depth, but they are more common in shallow waters. Their capture in 2018, and notably within the ICES divisions 7e and 7f was via rods and lines and gill and entangling nets. Across 7e and 7f the total weight of European sea bass landed was over 256 (tonnes) and the total value was over £2.6 million.

Lemon Sole (Microstomus kitt)

Lemon sole are marine, demersal and oceanodromous with a depth range of 10-200m, mostly living on stony bottoms. Their capture in 2018, and notably within the ICES division 7e, was via demersal trawls. Across 7e the total weight of Lemon sole landed was over 483 (tonnes) and the total value was over £2.6 million.

European Hake (Merluccius merluccius)

European hake are marine and demersal with a depth range of 30-1075m, but usually found between 70 and 370 m depth. Adults live close to the bottom during day-time, but move off-bottom at night. Their capture in 2018, and notably within the ICES divisions 7e, 7g and 7f, was via gill and entangling nets. Across 7e, 7g and 7f the total weight of European hake landed was over 878 (tonnes) and the total value was over £2.3 million.

Brill (Scophthalmus rhombus)

Brill are marine, demersal and oceanodromous with a depth range of 5-50m, living on sandy or mixed bottoms. Their capture in 2018, and notably within the ICES division 7e, was via beam trawls. Across 7e the total weight of brill landed was over 216 (tonnes) and the total value was over £1.5 million.

John Dory (Zeus faber)

John dory are marine, brackish, benthopelagic, oceanodromous with a depth range of 5-400m. Found in areas close to the seabed (soft and hard) and generally solitary. Their capture in 2018, and notably within the ICES division 7e, was via demersal trawls. Across 7e the total weight of john dory landed was over 207 (tonnes) and the total value was over £1.3 million.

Pollack (Pollachius pollachius)

Pollack are marine, benthopelagic and oceanodromous with a depth range of 40-200m. Found in inshore waters but also down to 200 m depth, in areas with hard bottoms. Their capture in 2018, and notably within the ICES division 7e, was via gill and entangling nets. Across 7e the total weight of pollack landed was over 609 (tonnes) and the total value was over £1.3 million.

20.12.2 Pelagic Fisheries

European Pilchard (Sardina pilchardus)

European pilchard are marine, freshwater, brackish, pelagic-neritic and oceanodromous with a depth range of 10-100m. Littoral species that forms schools, usually at depths of 25 to 55, or even 100 m by day, rising to 10 to 35 m at night. Their capture in 2018, and notably within the ICES divisions 7e and 7f, was via purse seines, gill nets and entangling nets and demersal seines. Across 7e and 7f the total weight of European pilchard landed was over 8,100 (tonnes) and the total value was over £2.8 million.

Atlantic mackerel (Scomber scombrus)

Atlantic mackerel are marine, brackish, pelagic-neritic and oceanodromous with a depth range of 0-1,000m. Abundant in cold and temperate shelf areas they form large schools near the surface. They overwinter in deeper waters but move closer to shore in spring when water temperatures range between 11° and 14°C. Their capture in 2018, and notably within the ICES divisions 7f and 7e, was via rods and lines. Across 7f and 7e the total weight of Atlantic mackerel landed was 762 (tonnes) and the total value was over £977,000.

European Anchovy (Engraulis encrasicolus)

European anchovy are marine, brackish, pelagic-neritic and oceanodromous with a depth range of 0-400m. Mainly a coastal marine species, forming large schools. Tolerates salinities of 5-41 ppt and in some areas, enters lagoons, estuaries and lakes, especially during spawning. Tends to move further north and into surface waters in summer, retreating and descending in winter. Their capture in 2018, and notably within the ICES division 7e, was via purse seines and pelagic trawls. Across 7e the total weight of European anchovy landed was 446 (tonnes) and the total value was over £502,000.

European Sprat (Sprattus sprattus)

European sprat are marine, brackish, pelagic-neritic and oceanodromous with a depth range of 10-150m. Usually inshore schooling, sometimes entering estuaries (especially the juveniles) and tolerating salinities as low as 4 ppt. Shows strong migrations between winter feeding and summer spawning grounds. Moves to the surface at night. Their capture in 2018, and notably within the ICES division 7e, was via pelagic trawls. Across 7e the total weight of European sprat landed was over 1,800 (tonnes) and the total value was over £432,000.

Horse Mackerel (Sarda sarda)

Horse Mackerel are marine, brackish, pelagic-neritic and oceanodromous with a depth range of 80-200m. Epipelagic, neritic and a schooling species that may enter estuaries. Their capture in 2018, and notably within the ICES divisions 7h and 7f, was via pelagic trawls. Across 7h and 7f the total weight of horse mackerel landed was over 381 (tonnes) and the total value was over £246,000.

20.12.3 Crustaceans and Molluscs

Brown Crab (Cancer pagurus)

Brown crab is a marine crustacean of the family Cancridae. Abundant throughout the northeast Atlantic on mixed coarse grounds, mud, and sand from the shallow sublittoral to depths around 100m. It is frequently found inhabiting cracks and holes in rocks, but occasionally also in open areas. Their capture in 2018, and notably within the ICES divisions 7e, 7f and 7g was via pots and traps. Across 7e, 7f and 7g the total weight of brown crab landed was over 5991 (tonnes) and the total value was over £16.3 million.

Cuttlefish (Sepoa apama)

Cuttlefish is a marine mollusc of the order Sepiida. Inhabits tropical and temperate ocean waters. They are mostly shallow-water animals, although they are known to go to depths of about 600m. Their capture in 2018, and notably within the ICES division 7e, was via beam trawls, demersal trawls and pots and traps. Across 7e the total weight of cuttlefish landed was over 3,631 (tonnes) and the total value was over £13 million.

King Scallop (Pecten maximus)

King scallop is a marine mollusc of the family Pactinidae. Tends to be more numerous in areas where they are not fully exposed to strong currents. Their capture in 2018, and notably within the ICES division 7e, was via dredges. Across 7e the total weight of king scallop landed was over 4610 (tonnes) and the total value was over £12.4 million.

European Lobster (Homarus gammarus)

European lobster is a marine crustacean of the family Nephropidae. Live in all oceans, on rocky, sandy, or muddy bottoms from the shoreline to beyond the edge of the continental shelf. They generally live singly in crevices, or in burrows under rocks. Their capture in 2018, and notably within the ICES divisions 7f and 7e was via pots and traps. Across 7f and 7e the total weight of European lobster landed was over 392 (tonnes) and the total value was over £5.3 million.

Common Whelk (Buccinum undatum)

Common whelk is a large marine gastropod of the family Buccinidae. Found mainly on soft bottoms in the sublittoral zone, and occasionally on the littoral fringe, where it is sometimes found alive at low tide. It does not adapt well to life in the intertidal zone, due to its intolerance for low salinities. Their capture in 2018, and notably within the ICES divisions 7e and 7f was via pots and traps. Across 7e and 7f the total weight of common whelk landed was over 2758 (tonnes) and the total value was over £3.4 million.

Nephrops (Nephrops norvegicus)

Nephrops is a marine crustacean of the family Nephropidae. Live in all oceans, on rocky, sandy, or muddy bottoms from the shoreline to beyond the edge of the continental shelf. They generally live singly in crevices, or in burrows under rocks. Their capture in 2018, and notably within the ICES divisions 7h and 7g was via demersal trawls. Across 7h and 7g the total weight of nephrops landed was over 587 (tonnes) and the total value was over £1.7 million.

20.13 Marine Cable Route Interactions (% Overlap)

Only short sections of the marine cable route passes through the south of 7g, to the western corners of 7f and 7e and to north east corner of 7h (see Figure 20.1).

The % overlap of the ICES divisions with the marine cable route are given in Table 20.4.

Table 20.4 ICES Divisions and Marine Cable Route (% Overlap)

ICES Division (ref)	Area (km^2)	Marine Cable Route (within ICES Division)	Area (km^2)	% Overlap
7g	47,586.4	7g	263.0	0.55%
7f	57,060.7	7f	234.2	0.41%
7e	56,369.8	7e	180.8	0.32%
7h	18,876.4	7h	28.4	0.15%

20.14 Target Species Weight and Value Comparisons (Per Total UK EEZ Landings %))

A comparison of UK vessel landings from ICES sub-divisions that interact with the marine cable route, for which full data was available (2016), is presented in Tables 20.5 to 20.10. Ten of the highest value target species are reported (per ICES sub-division). Landings are then compared to the total UK EEZ landings and a % figure is determined to put value into a wider context.

Table 20.5 Tonnage and Values of the Ten Highest Value Target Species in 2016 – from ICES Sub-Division 30E2 (MMO, 2016)

Species, Tonnage and Value (£) UK Vessel Landings From ICES Sub Division 30E2 (MMO, 2016)				Landings Value (£) Compared to Total UK EEZ Landings (%)
Species	**Species Group**	**Tonnes caught (t)**	**Value (£)**	
Hake	Demersal	34.34	74,848.67	0.22%
Nephrops	Shellfish	10.81	30,738.33	0.03%
Monks or Anglers	Demersal	5.32	14,443.81	0.02%
Turbot	Demersal	1.83	13,025.83	0.18%
Haddock	Demersal	8.00	11,436.09	0.03%
Pollack	Demersal	3.14	8,471.57	0.16%
Cod	Demersal	3.16	7,987.80	0.02%
Megrim	Demersal	2.37	6,743.50	0.05%
Saithe	Demersal	3.78	4,613.35	0.04%
Smoothhound	Demersal	3.39	3,629.88	0.99%

Table 20.6 Tonnage and Values of the Ten Highest Value Target Species in 2016 – from ICES Sub-Division 29E2 (MMO, 2016)

Species, Tonnage and Value (£) UK Vessel Landings From ICES Sub Division 29E2 (MMO, 2016)				Landings Value (£) Compared to Total UK EEZ Landings (%)
Species	**Species Group**	**Tonnes caught (t)**	**Value (£)**	
Hake	Demersal	229.02	509,317.04	1.50%
Nephrops	Shellfish	121.29	488,668.64	0.47%
Pollack	Demersal	35.24	90,926.18	1.72%

Species, Tonnage and Value (£) UK Vessel Landings From ICES Sub Division 29E2 (MMO, 2016)				Landings Value (£) Compared to Total UK EEZ Landings (%)
Species	Species Group	Tonnes caught (t)	Value (£)	
Monks or Anglers	Demersal	29.52	89,890.09	0.15%
Turbot	Demersal	5.23	50,177.47	0.70%
Cod	Demersal	15.41	43,536.18	0.08%
Haddock	Demersal	21.38	42,020.98	0.09%
Ling	Demersal	17.70	24,357.05	0.31%
Sole	Demersal	1.88	24,170.21	0.13%
Megrim	Demersal	12.75	21,902.99	0.15%

Table 20.7 Tonnage and Values of the Ten Highest Value Target Species in 2016 – from ICES Sub-Division 29E3 (MMO, 2016)

Species, Tonnage and Value (£) UK Vessel Landings From ICES Sub Division 29E3 (MMO, 2016)				Landings Value (£) Compared to Total UK EEZ Landings (%)
Species	Species Group	Tonnes caught (t)	Value (£)	
Hake	Demersal	112.13	257,773.38	0.76%
Crabs (C.P.Mixed)	Shellfish	103.90	135,741.64	0.29%
Monks or Anglers	Demersal	36.84	108,069.83	0.18%
Pollack	Demersal	23.45	71,697.75	1.35%
Megrim	Demersal	30.11	71,291.03	0.48%
Turbot	Demersal	7.84	62,860.52	0.88%
Lobsters	Shellfish	5.21	48,251.15	0.12%
Sole	Demersal	4.60	47,722.60	0.27%
Cod	Demersal	14.89	33,546.63	0.06%
Haddock	Demersal	12.50	23,802.68	0.05%

Table 20.8 Tonnage and Values of the Ten Highest Value Target Species in 2016 – from ICES Sub-Division 28E3 (MMO, 2016)

Species, Tonnage and Value (£) UK Vessel Landings From ICES Sub Division 28E3 (MMO, 2016)				Landings Value (£) Compared to Total UK EEZ Landings (%)
Species	**Species Group**	**Tonnes caught (t)**	**Value (£)**	
Monks or Anglers	Demersal	181.87	533,897.34	0.89%
Sole	Demersal	35.92	438,035.83	2.44%
Megrim	Demersal	128.43	309,077.23	2.08%
Crabs (C.P.Mixed)	Shellfish	200.25	279,074.38	0.59%
Lobsters	Shellfish	21.50	224,583.54	0.57%
Lemon Sole	Demersal	22.51	107,356.72	1.10%
John Dory	Demersal	13.49	102,062.98	6.36%
Nephrops	Shellfish	22.67	79,644.89	0.08%
Turbot	Demersal	8.57	77,971.41	1.09%
Haddock	Demersal	36.86	77,309.10	0.17%

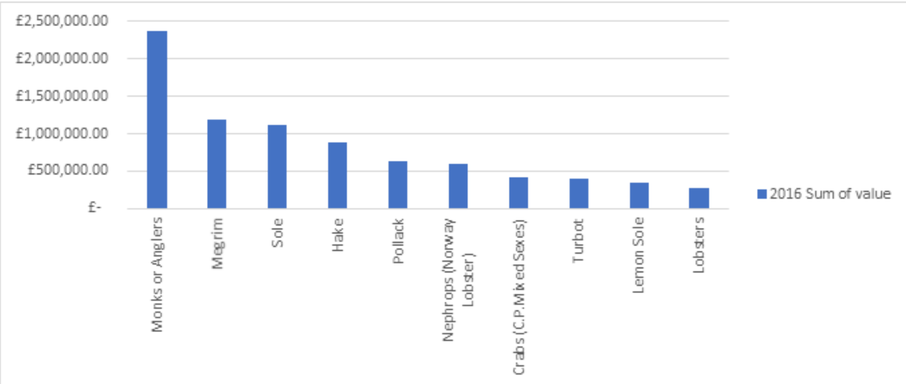
Table 20.9 Tonnage and Values of the Ten Highest Value Target Species in 2016 – from ICES Sub-Division 27E3 (MMO, 2016)

Species, Tonnage and Value (£) UK Vessel Landings From ICES Sub Division 27E3 (MMO, 2016)				Landings Value (£) Compared to Total UK EEZ Landings (%)
Species	**Species Group**	**Tonnes caught (t)**	**Value (£)**	
Monks or Anglers	Demersal	348.94	1,013,473.59	1.69%
Megrim	Demersal	186.01	527,932.61	3.56%
Sole	Demersal	35.89	437,563.77	2.44%
Turbot	Demersal	10.78	107,500.62	1.51%
Lemon Sole	Demersal	18.05	103,096.10	1.05%
Pollack	Demersal	29.70	66,461.13	1.25%
Cuttlefish	Shellfish	27.78	64,328.39	0.45%
Haddock	Demersal	18.93	39,232.32	0.09%
Cod	Demersal	13.80	38,316.92	0.07%
John Dory	Demersal	3.18	24,358.07	1.52%

20.15 Annual Landings Value for the Ten Highest Value Target Species (Project Area)

The annual landings value (£) for ten of the highest value target species, from all six ICES Sub-divisions across the Project area, are illustrated in Figure 20.7.

Figure 20.7 Annual Landings Value (£) for the Ten Highest Value Target Species from all ICES Sub-divisions (Project Area) (MMO, 2016).



20.16 Potential Impacts

During the laying, operation and removal of subsea cables, there is potential for a number of impacts to occur that may affect commercial fishery interests. Potential impacts include damage or disturbance to fishing grounds, temporary displacement of fishing activity, placement of seabed obstructions, electromagnetic fields and heat emission, which can affect fish behaviour.

The potential sources of impact and effects during the construction and operational phases are presented in Table 20.10.

Table 20.10 Potential Impact to Commercial Fisheries (Construction and Operation)

Potential Source of Impact	Potential Effect
Construction Phase	
Damage / disturbance to fishing grounds during installation.	Temporary loss of traditional fishing grounds.
Displacement of fishing activity by cable installation activities	Reduction in access to, or exclusion from, potential and/or established fishing grounds.

Potential Source of Impact	Potential Effect
Seabed obstructions (cables on the seabed)	Potential impact of gear snagging along the cable corridor route
Operational Phase	
Seabed obstructions (cable protection)	Potential impact of gear snagging along the cable corridor route
Exposed cable (safety risk)	Potential impact of gear snagging along the cable corridor route
Disruption of fishing activity from repairs/maintenance work	Reduction in access to, or exclusion from, potential and/or established fishing grounds.
Cable exposed following cable maintenance/repair.	Potential impact of gear snagging along the cable corridor route
Electromagnetic fields (EMF) emitted by offshore cable causing behavioural responses in fish and shellfish receptors.	Disturbance to fish and shellfish may result in an indirect effect on commercial fisheries.

It is not anticipated that there will be any long-term restrictions around the marine cable route. However, as with other installed seabed infrastructure, the marine cable will be included on charts, and fishing vessels, as with other marine users, need to be aware that the marine cable is present, and act accordingly. Vessel masters will also be responsible for any damage caused to charted cables, in line with international maritime law.

Commented [A63]: Placeholder: All mitigation measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

20.17 Mitigation

As part of the assessment process design mitigation measures have been proposed to reduce the potential for impacts on commercial fisheries (Table 20.10), and these have been taken into account, when considering the impact significance in Table 20.11. These measures are considered standard industry practice for a development of this type (BERR, 2008; FLOWW, 2014).

Table 20.11 Mitigation Measures to be Adopted to Protect Commercial Fisheries Interests

Mitigation Ref.	Measures Adopted as Part of Project	Reasoning
Construction		
A	The developer will appoint a Fisheries Liaison Officer (FLO) during the project who will maintain communication with fisheries representatives and organisations throughout construction and	Ensure appropriate and proactive communication.

Mitigation Ref.	Measures Adopted as Part of Project	Reasoning
	installation in accordance with good practice (Fishing Liaison with Offshore Wind and Wet Renewables (FLOWW), 2014).	
B	Application for and use of 500m (radius) mobile safety zones around all maintenance operations.	Ensure navigational safety.
C	Advanced warning and accurate location details of construction operation and associated mobile safety zones. Safety zones to be brought to the attention of mariners, with as much advance warning as possible, via frequent notice to Mariners, and other means e.g. the Kingfisher Bulletin, VHF radio broadcasts etc. and through direct communications via the FLO.	Ensure sufficient notice for either gear removal and/or avoidance of construction areas. Ensure navigational safety.
D	Use of appropriate installation methods, as determined by seabed type.	Damage / disturbance to fishing grounds during installation.
E	Seabed obstructions created by installation of the offshore cables, that are considered to pose a risk to the fishing industry will be made safe for towed fishing gear.	Ensure operational safety - minimising risk of gear snagging.
F	Seabed obstruction such as rock berms and concrete mattressing will be installed where adequate cable burial has not been possible. They will be designed to have a smooth over-trawlable profile so that they do not present an obstruction to fishing activity.	Ensure operational safety - minimising risk of gear snagging.
G	Guard vessels will be used for any sections of marine cables left temporarily unburied or unprotected during installation operations.	Ensure operational safety - minimising risk of gear snagging.
Operation		
H	Advance warning and accurate location details of maintenance operations and associated advisory safety zones, to be published through regular Notice to Mariners, and through direct communications via the FLO.	Ensure sufficient notice for either gear removal and/or avoidance of maintenance area.
I	Application for and use of 500m safety zones around all maintenance operations.	Ensure navigational safety.

Mitigation Ref.	Measures Adopted as Part of Project	Reasoning
J	FLO to advise all fishing fleets of emergency procedures to be adopted in instances of fouling a submarine cable/structure (KIS-ORCA Emergency Procedures) through on-going liaison with all fishing fleets via the FLO.	Ensure appropriate and proactive communication.
K	Notification of all offshore and seabed structures (e.g. via Kingfisher Information Service - Cable Awareness (KISCA) Charts).	Minimise risk of gear snagging.
L	Bathymetric survey to be undertaken following completion of installation or repair works to ensure that the cables have been buried or protected and sediment is able to move over any installed cable protection.	Minimise risk of gear snagging.
M	In the instance that snagging does occur, protocols are laid out within the guidance by the FLOWW and 'Recommendations for Fisheries Liaison: Best Practice' guidance for offshore renewable developers, in particular Section 9: Dealing with claims for loss or damage of gear (BERR, 2008).	Manage occurrence of gear snagging.

20.18 Impact Assessment

20.18.1 Construction Phase Effects

Damage / Disturbance to Fishing Grounds During Installation

During the construction phase, there is potential for damage/disturbance to traditional fishing grounds during installation. This has been assessed as being a potential temporary loss in sediment areas (first 34km and last 57km of the route) and a permanent deformation in rock areas (120km of the route to the west of the Isles of Scilly). Particularly this would be as a result of seabed preparation/boulder clearance, cable burial and trenching operations (using a plough, mechanical trenching and specialist rock cutting tools) and potential rock protection or mattressing (potentially required to the south west of the Isles of Scilly).

For seabed preparation/boulder clearance and burial and trenching operations, the magnitude of potential impacts, is considered to be Negligible, with intermittent and temporary (less than one month) interference to localised fishing grounds. Especially, as the burial and trenching operations will be advancing along the marine cable route at a rate of 1.5km per day, and for a total of 139 days only. Further, the footprint of the cable installation is only anticipated to be c.5-15m wide depending on the size of the equipment deployed and percentage overlap of the cable route with the adjacent ICES divisions is <1% for each division (from Table 20.4).

For potential rock protection or mattressing, the impact magnitude, is considered to be High, with permanent (greater than three years) interference to the localised fishing grounds.

The sensitivity, or importance, of this receptor has varied capacity to absorb change, fisheries interest and importance. The identified sediment areas are considered to be Medium, as their profile will be returned when the cable is buried/backfilled, they have moderate fisheries interest, with monk or angler fish, common sole, turbot, European hake, brill, brown crab, king scallop, European lobster, common whelk and Nephrops all known to occupy muddy, sandy and mixed substrate areas. Also, these areas and target species within the Project area, are considered to be of Regional importance (referring to the 2018 and 2016 landings data, values and comparisons reported in the preceding sections). On this basis, and with design mitigation embedded, the magnitude of the effect has been assessed as Negligible or minor and not significant.

The identified rock areas are considered to be Medium, as their profile will be deformed with potential rock protection or mattressing (even though these features provide structure and cover for some of target species), they have moderate fisheries interest, with European plaice, turbot, lemon sole, brill, pollack and lobster all occupying rocky, stony and mixed substrate areas. Also, these areas and target species within the Project area are considered to be of Regional importance (referring back to the 2018 and 2016 landings data, values and comparisons reported in the preceding sections). On this basis, and with design mitigation embedded, the magnitude of the effect has been assessed as Negligible or minor and not significant.

Displacement of Fishing Activity by Cable Installation Activities

During the construction phase, there is potential for displacement of fishing activity by cable installation activities. There will be a mobile safety zone around the cable laying operation of 500m (radius) that will progress at a rate of 275m/hr where standard cable burial tools are employed reducing to 40m/hr over chalk out crops where specialist rock cutting tools are required for trenching. Where cable burial is not possible simultaneously to laying, or where burial is not possible and protection such as mattressing is required (e.g. crossing of other infrastructure or areas of hard seabed), the cable may remain unprotected for a period of up to 6-8 weeks.

Fishing with static gear (gill nets, traps and pots) within the footprint of the cable lay corridor will not be possible during the period of installation and cable lay will result in short-term exclusion from the fishing grounds.

Similarly, trawl gear such as otterboard and beam trawls and scallop dredges will also require to be excluded from a 500m safety zone around the cable lay operation and from any unprotected, or temporary unburied sections of the cable.

The area of exclusion is both small and temporary and the offshore static gear fishery is expected to be able to move gear from locations of construction operations given adequate notification. Similarly, the offshore fleet has access to high levels of alternative fishing grounds during the temporary exclusion.

The sensitivity, or importance, of this receptor has varied capacity to absorb change, fisheries interest and importance. The sensitivity of commercial fisheries to displacement is considered to be Low, as it will be restricted to small areas of the cable route at any given time and the cable laying schedule has been designed to minimise exclusion periods. The proposed cable route avoids the main *Nephrops* fisheries located to the north east and west of the cable route. Also, fishing activity (notably demersal and beam trawlers) and the demersal fishery is widespread across the Project area.

These fisheries are assessed as having high recoverability following damage / disturbance. Once installation is complete, static and trawl gear can be re-deployed in the area, as required.

The impact magnitude is considered to be Negligible, with intermittent and temporary (less than one month) interference to localised fishing grounds, and temporary nature of the safety zones. On this basis, and with design mitigation embedded, the magnitude of the effect has been assessed as Negligible or minor and not significant.

Seabed Obstructions (Cables on the Seabed)

During the construction phase, there is potential for impact of gear snagging along the marine cable. Where surface sediment comprises loose to dense sand, dense sandy gravel and clay, the marine cable will be simultaneously laid and buried; however over boulder outcrops, or where the cable trench requires specialised rock cutters, simultaneous cable laying and burial may not be possible. At such locations subsequent cable burial may require a back-filling pass post lay to close the trench back over, or where trenching is not deemed feasible e.g. due to the presence of a boulder field, hard rock, or third party infrastructure, or where remedial secondary protection measures are required (for example where depth of lay cannot be achieved) and where external cable protection may be required. Possible external cable protection may include rock protection, or a concrete mattress. Within such areas the cable may remain unprotected for a period of up to 6-8 weeks, during which period it could present a safety risk to demersal trawlers fishing in the vicinity, which may potentially snag their gear on the exposed cable.

Intensive use of trawl gear along the proposed marine cable presents a potential safety risk that may result from any trawl interaction with an unburied cable to fishing vessel. Despite design mitigation of a 500m safety zone around any unburied, or unprotected cable lengths and publication of a notice to mariners, this risk and sensitivity has been assessed as High.

Once cable burial is complete or external cable protection installed, static and trawl gear can be re-deployed in the area, as required. Given the localised and temporary nature (139 days) of the impact along with the embedded design mitigation the impact magnitude has been assessed as Low. The magnitude of the effect has been assessed as Minor or moderate and not significant.

20.18.2 Operational Phase Effects

Seabed Obstructions (Cable Protection)
During the operational phase, structures on the seabed represent potential snagging points for fishing gear and could lead to damage to, or loss of, fishing gear.

The target depth of lay for the offshore cable is between 0.8 and 2.5m and will be subject to a cable burial assessment, where cable protection (rock placement) would not be required. Where the target depth of lay cannot be achieved, cable protection may be required. Cable protection would take the form of rock placement or a concrete mattress.

Rock placement or concrete mattressing, as a means of primary cable protection, may be required within a 120km section of the marine cable route to the west of the Isles of Scilly.

Rock placement or concrete mattresses/sleepers will also be used for the construction of third-party infrastructure crossings. There are 19 in-service telecommunication cable crossings identified along the cable route to date, 10 of which are within the UK EEZ. Each cable crossing will require a specific crossing design to be agreed with each asset owner.

Both rock berms and concrete mattresses are designed to protect the cable and have an over-trawlable profile.

The locations of any rock placement, rock berm or concrete mattress would be communicated to all fishermen via Notice to Mariners.

The design of the cable protection indicates that sensitivity to cable protection is Low to all fishing fleets. The impact magnitude has been assessed as Low, due to the small extent and localised nature of cable protection. The magnitude of the effect of cable protection to all commercial fishing operations has been assessed as Negligible or minor and not significant.

Exposed Cable (Safety Risk)
Target depth of lay for the offshore cable throughout the UK EEZ lies between 0.8 and 2.5m, however over the lifetime of the cable scour resulting from *inter alia* tides and currents may become partially or totally unburied. Should any section of the offshore cable become exposed during the operational phase, this could present a serious risk to fishing activities in the vicinity. Exposed cable represents a potential snagging points for fishing gear and presents a significant hazard to fishing vessels potentially resulting in damage to, or loss of, fishing gear and in extreme cases may compromise the safety of the vessels. The safety risks associated with the possible exposure of buried cable is considered of high fisheries interest and the sensitivity has been assessed as High.

The impact magnitude has however been assessed as Low, as due to the initial depth of lay and the metocean conditions along the cable route, it is considered unlikely the offshore cable will become exposed after installation.

The metocean conditions along this section of the cable route can be divided in two halves:

- The first half (northern section of the cable in the UK EEZ to the west of the UK mainland) is characterised by weak currents and tides, high exposure to swell and strong wind field; and

- The second half (southern section of the cable in the UK EEZ to the west of the English Channel) is characterised by medium currents and tides, high exposure to swell, medium wind field. Tides and currents increase quickly towards the south.

Close to the Isles of Scilly the probability of superficial sediment mobility induced by currents is high (70 - 90%). This is due to an acceleration of currents near the islands. The sediment thickness that can be impacted by mobility is generally less than 1m but can reach 1.5 to 2.5m in some very localised areas.

Current-induced sediment mobility occurs mostly beyond the 80m water depth. The sediment thickness, that can be impacted by mobility across the offshore part of the route, is generally less than 1m.

The target depth of lay for the cable is c. 2.5m. Where the target depth of lay cannot be met, design mitigation, such as secondary rock cable protection will be installed. Where the cable cannot be placed within a trench or requires crossing third party infrastructure the cable will be protected by rock placement or concrete mattressing.

Routine monitoring and maintenance of the cable corridor in line with good practice (BERR 2008) during the operational phase should ensure the integrity of the cable is maintained, thus minimising snagging risk and reducing the impact magnitude to Negligible. The magnitude of the effect has been assessed as Minor and not significant.

Disruption of Fishing Activity from Repairs/Maintenance Work
Should maintenance or repair activities be required for the offshore cable during its lifetime it may be necessary for the developer to apply for a safety zone of up to 500m to be implemented around the zone of operations. Notice to Mariners will be issued in advance of any maintenance works. Potting vessels and vessels fishing static gear may be required to move pots and nets during maintenance works, although such works are likely to be both temporary and infrequent. The commercial fishing fleets are considered to have high availability of alternative fishing grounds during the period of localised exclusion and an operational range that is not limited to the footprint of the offshore cable route.

Disruption caused by maintenance works has been assessed as **Low,** as seasonal fishing cannot be avoided if maintenance work becomes necessary, however the works would be temporary.

The impact resulting from maintenance work to the offshore cable route is predicted to be of local spatial extent and of short-term duration. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be Low for all fishing fleets. The magnitude of the effect has been assessed as Negligible or minor and not significant.

Cable Exposed Following Cable Maintenance/Repair.
The life expectancy for the cable is estimated to be at least 40 years; however during the operational life there may be requirement for cable repair. Where a cable has been lifted from the seabed for repair there is the potential for a bight to form in the cable, where it has been repaired following it being lowered to the bed, which may stand proud of the seabed,

presenting a hazard to fishing activities e.g. potential for fouling by trawl doors. Repaired lengths of cable are however typically reburied using remotely operated vehicles (ROVs).

A residual hazard to fishing gear following a cable repairs is however the 'Final Splice Bight'. Burial of this section of cable, which is used to raise and lower the main cable to the cable ship, is often not completely successful due to the sharp turns in the cable and poor visibility conditions at the seabed during burial, therefore a potential for interaction of the final splice bight with trawls, or static gear anchors, is increased. It is advised therefore that fishing vessels avoid trawling over final splices.

The impact magnitude of stemming from surface exposure of a final splice bight is considered Medium, as although the likelihood of a cable repair within the lifetime of the cable, given the initial burial depth and /or protection afforded to the cable in and the UK EEZ is low, it is recommended that subsequent avoidance of the seabed in the area of the repair would be long term. However, given the localised nature of any impact, which would not be of significant detriment to the character of the fishery the sensitivity has been assessed as Low.

The location of the repair shall be communicated to the fishing fleet through e.g. a Notice to Mariners, KIS-ORCA, as well as, through direct communications with the fleet from the FLO. The magnitude of the effect has been assessed as Minor and not significant.

Electromagnetic Fields (EMF) Emitted by Offshore Cable Causing Behavioural Responses in Fish and Shellfish Receptors.

Submarine power cables can generate localised electromagnetic fields (EMF) in the surrounding seabed and water. The EMF is composed of both an electric (E) and an induced magnetic (B) field (Cada *et al.* 2011) that will radiate into the environment within the immediate vicinity. Electric fields are normally fully contained within the insulation surrounding the cable and are not sensed by fish, whilst B fields propagate outside the cable and can be sensed by electro-sensitive species. Where a fish or tidal movement occurs through a B field, a further induced electric (iE) field can be created (Gill & Bartlett, 2010). Both the B and iE components of EMFs are within the range of detection by EM-sensitive aquatic species, such as sharks and rays (Elasmobranchii) (Nedwell, 2007). The main potential impact of any electric field is the disruption of the sensory cues for feeding in benthic dwelling elasmobranchii (BERR, 2008). Two possible effects could result from this behavioural disruption. Firstly, resident elasmobranchii could be deterred from feeding along the linear field where the cable is buried. Secondly, the impact could be one of attraction of elasmobranchii to the vicinity of the cable corridor potentially causing an unnatural clustering effect in the area (BERR, 2008).

There is a paucity of research into the response of shellfish to EMF. Whilst commercially important species of crustacea including lobster and brown crab have been shown to demonstrate a response to the weaker B fields (Boles and Lohmann, 2003) it is uncertain whether these species are able to detect and respond to magnetic fields. There are no published findings from post construction monitoring programmes for offshore cable routes, or windfarms, that suggest sensitive species of crustaceans or molluscs have been affected by the presence of submarine power cables. And, whilst there is limited data available on which to base an assessment, the commercial species are all mobile and the magnetic fields highly localised around the cable within a widespread habitat and as such crustacea are able to avoid the impacted areas.

The strength of the magnetic field (and consequently, induced electrical fields) decreases rapidly horizontally and vertically with distance from source. It is however unlikely that cables can be buried at depths that will reduce the magnitude of the B field, and hence the sediment-sea water interface iE field, below a level that could be detected by certain marine organisms on or close to the seabed (Gill *et al*., 2009).

Whilst smooth-hound are one of the target species recorded within ICES Sub-division 30E2 they are typically caught as a bycatch in the demersal fisheries that are primarily targeting gadoids and other flatfish. Total landings from this ICES Sub-division were low and valued at £3,629,000 in 2016 (MMO, 2016).

Elasmobranchs do not form a targeted fishery in the area adjacent to the offshore cable corridor and are taken in low quantities. The cable corridor does not pass-through known spawning or nursery habitat for smooth-hound. The sensitivity of commercial fisheries as determined by displacement or disturbance of commercially important fish and shellfish species as a result of EMF is considered Low. The potential consequence or impact magnitude upon commercial fisheries is considered Negligible. The magnitude of the effect has been assessed as Negligible or Minor and not significant.

20.18.3 Decommissioning Phase Effects

A decommissioning plan will be prepared prior to the decommissioning phase of the proposed development, which is expected to be at least 40 years from the start of operation. It is currently anticipated that the cable and associated external cable protection will be left in-situ where this is deemed environmentally acceptable; this may require a level of long-term monitoring and maintenance. There are not expected to be any effects on commercial fisheries as a result of this proposed course of action. However, any works required for decommissioning will be subject to future consent applications, and environmental assessments, as relevant.

20.18.4 Cumulative Effects

TBC

Commented [A64]: Placeholder for cumulative assessment

20.19 Summary of Potential Impacts

Table 20.12 Summary of Potential Impacts, Mitigation and Significance

Potential Impacts	Commercial Fisheries Assessment			
Receptor	Sensitivity	Magnitude	Mitigation	Significance
Construction Phase				
Damage / disturbance to fishing grounds during installation.	Medium and Medium	Negligible and High	E	Negligible or Minor.

Potential Impacts Receptor	Commercial Fisheries Assessment			
	Sensitivity	**Magnitude**	**Mitigation**	**Significance**
Displacement of fishing activity by cable installation activities.	Low	Negligible	A, B, C, H	Negligible or Minor.
Seabed obstructions (cable on the seabed).	High	Low	A, F, G, H	Minor or moderate.
Operational Phase				
Seabed obstructions (cable protection).	Low	Low	K, L, M, N	Negligible or Minor
Exposed cable (safety risk).	High	Negligible	K, L, M, N	Minor
Disruption of fishing activity from repairs/maintenance work.	Low	Low	I, J,	Negligible or Minor
Cable exposed following cable maintenance/repair.	Low	Medium	K, L, M, N	Minor
Electromagnetic fields.	Low	Negligible	M	Negligible or Minor

20.20 References

Anatec (2016) - Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Appendix B – VMS Fishing analysis. Ref. no. A3728-RTE-AP-2, Rev. 1. January 2016. Report prepared for EirGrid and RTE by Anatec Limited.

Anatec (2016) - Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Ref. no. A3728-RTE-RA-2, Rev. 4. April 2016. Report prepared for EirGrid and RTE by Anatec Limited.

BERR (2008) review of cabling techniques and environmental effects applicable to the offshore wind farm industry. Technical Report Department for Business, Enterprise and Regulatory Reform. JANUARY 2008. Pp 164.

Boles LC, Lohmann KJ. True navigation and magnetic maps in spiny lobsters. Nature. 2003 Jan 2;421(6918):60-3. doi: 10.1038/nature01226. PMID: 12511953.

Cada, G. F., Bevelhimer, M. S., Riemer, K. P., & Turner, J. W. (2011). Effects on freshwater organisms of magnetic fields associated with hydrokinetic turbines. FY 2010 Annual Progress Report. Prepared for the Wind and Water Power Program, Office of Energy Efficiency and Renewable Energy, US Department of Energy. Oak Ridge National Laboratory: Oak Ridge, TN.

Celtic Interconnector Study Synthesis. Prepared by Wood Group for EirGrid & RTE. Doc Ref: 400584-PL-REP-001, Rev: H. July 2019.

Celtic Interconnector Project. Fishing Activity Report. November 2013. Report for EirGrid and RTE by NetWork Services.

Fishing Liaison with Offshore Wind and Wet Renewables (FLOWW) (2014) - FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison.

Gill, A.B., Huang, Y., Gloyne-Philips, I., Metcalfe, J., Quayle, V., Spencer, J. and Wearmouth, V. (2009). COWRIE 2.0 Electromagnetic Fields (EMF) Phase 2: EMF-sensitive fish response to EM emissions from sub-sea electricity cables of the type used by the offshore renewable energy industry. COWRIE-EMF-1-06.

Gill, A.B. & Bartlett, M. (2010). Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon , sea trout and European eel, Scottish Natural Heritage Commissioned Report No. 401.

ICES - ICES eco system data portal (https://ecosystemdata.ices.dk/).

Lohmann, Kenneth & Ernst, David. (2014). The geomagnetic sense of crustaceans and its use in orientation and navigation. In Crustacean Nervous Systems and their Control of Behaviour Editors: C. D. Derby, M. Thiel, Oxford University Press(pp.321-336).

MMO (2018) - United Kingdom commercial sea fisheries landings by Exclusive Economic Zone of capture: 2012 – 2018.

MMO (2016) - Landings data by Exclusive Economic Zone for all UK registered vessels 2016.

MMO (2018) - Landings data by Exclusive Economic Zone for all UK registered vessels 2012-18.

MMO (2016) - UK Sea Fisheries Statistics (2016.

Nedwell J.R., Parvin S.J., Edwards B., Workman R., Brooker A.G., Kynoch J.E. (2007), Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters, commissioned by COWRIE Ltd. Available at: http://mhk.pnnl.gov/wiki/images/6/69/COWRIE_Underwater_Noise_Windfarm_Construction.pdf [Accessed Nov 2013].

Richards (2013) Intertek Celtic Interconnector Project Fishing Activity Report. Network Services, Devon. Report to Intertek Metoc. Pp. 46.

Anatec Limited (2016) Celtic Interconnector Cable Risk Assessment - Appendix B: VMS Fishing Analysis. Report Ref. A3728-RTE-AP-2

21 Major Accidents and Disasters

21.1 Introduction

This chapter assesses the likely significant effects of the Celtic Interconnector Project with respect to major accidents and disasters in the marine environment. The chapter should be read in conjunction with the project description provided in Volume 4 Environmental Report for UK Offshore – Chapter 5: Project Description. It should also be read with respect to relevant parts of other chapters of this Environmental Report (ER) where common receptors have been considered and where there is an overlap or relationship between the assessment of effects. This notably includes Volume 4 Environmental Report for UK Offshore:

- Chapter 13: Marine Water Quality;
- Chapter 14: Biodiversity;
- Chapter 9: Population and Human Health;
- Chapter 19: Shipping and Navigation; and
- Chapter 20: Commercial Fisheries.

The Marine Works (Environmental Impact Assessment) Regulations 2017 (as amended) is the primary driver for the assessment of major accidents and disasters in the ER for the Celtic Interconnector as Schedule 3 requires these factors to be considered in decisions to grant consent for developments in the UK marine environment.

The four objectives of this chapter are to:

- Identify ways in which the Project could create sources of hazard or interact with any external sources of hazard that could result in a major accident or disaster;
- Identify any impact pathways from major accidents and disasters to the receiving environment;
- Determine whether the design measures, mitigations in place, legal requirements, and other industry codes or standards are adequate for the control of risk relating to the hazards identified; and
- Identify any residual impacts associated with the above.

For the purposes of this ER, major accidents are defined as an occurrence resulting from an uncontrolled event caused by a man-made activity or asset leading to serious damage on receptors. Possible examples may include:

- Industrial or mechanical failures resulting in fire, explosions, or the accidental release of pollutants;
- Accidents caused by the improper storage, transport or use of materials or substances;

- Transport-related accidents such as vessel collisions; and
- Intentional acts resulting in any of the outcomes previously described.

The term 'disaster' is used to describe a natural occurrence leading to serious damage on receptors. In both cases, the effects could be either immediate or delayed. Possible examples of disasters may include:

- Severe meteorological conditions such as high winds or seas affecting construction and maintenance vessels;
- Climatological extremes of temperature;
- Geophysical hazards such as landslides or earthquakes leading to structural collapse;
- Severe hydrological events such as storm surges or coastal/tidal flooding that affect human populations; and
- Biological hazards such as disease, swarms, or infestations.

21.2 Methodology and Limitations

21.2.1 Legislation and Guidance

A number of technical guidance documents relate to the consideration of risk relating to accidents and disasters in the context of environmental assessment and consenting, as follows:

- Reducing Risks Protecting People (R2P2) (Health and Safety Executive, 2001): R2P2 describes the Health and Safety Executive's (HSE) decision making process and presents the protocols and procedures followed in decision making in relation to the protection of human life in the UK. The tolerability criteria for risk to people, including the aversion for large numbers of casualties resulting from single incidents, has been referenced in setting the criteria for assessing the significance of effects on people.
- Environmental Impact Assessment of Projects, Guidance on Scoping (European Commission, 2017): Guidance on how to undertake a scoping assessment under the requirements of the new EIA Directive to ensure that sufficient information is included. The guidance provided by the European Commission highlights that a risk-based approach may be adopted in lieu of the typical sensitivity/extent criteria, where appropriate.
- Environmental Impact Assessment of Projects, Guidance on the Preparation of the Environmental Impact Assessment Report (European Union, 2017): Guidance on how to develop good quality environmental impact assessment reports to ensure appropriate information is available for decision making purposes. The guidance provided by the European Commission highlights that the context for inclusion of major accidents and disasters is to ensure that adequate focus is given to the provisions for events leading to significant risk, with an objective of building resilience in a development against such effects. The bar for what is tolerable to society is

therefore set somewhat more onerously for major accidents and disasters than for a smaller event of much lower magnitude.

- Guideline by the Chemical and Downstream Oil Industries Forum (CDOIF) – Environmental risk tolerability for COMAH establishments (CDOIF, 2016): Guidelines on the assessment and tolerability of Major Accidents to The Environment (established in relation to COMAH sites) produced by a joint industry and regulator forum.
- Guidance by Department of the Environment, Transport and the Regions (DETR) – Guidance on the Interpretation of Major Accidents to the environment for the purposes of COMAH Regulations (DETR, 1999): Guidance on what would constitute a major accident to the environment (from the perspective of COMAH regulations).
- Guide to predicting environmental recovery durations from major accidents. Supporting guide to the environmental risk tolerability for COMAH Establishments guideline (Energy Institute, 2017): Guidance which supports the assessment of potential consequences to the natural environment, specifically with respect to natural recovery from pollution events.
- The Institute of Environmental Management and Assessment (IEMA) has published a primer document that offers an assessment methodology based on current practices being employed in the UK (IEMA, 2020). It offers a proportionate method for the consideration of major accidents and disasters through screening, scoping and assessment and further reference is made to the approach presented in this chapter.

21.2.2 Desktop Studies

This chapter has been informed by data presented in other chapters as appropriate and has therefore taken the form of a desktop study. It has been informed by a desktop study undertaken during the scoping phase and the outcomes of the relevant technical assessments.

21.2.3 Field Studies

No surveys were undertaken to specifically inform this chapter of the ER. This chapter has, therefore, been informed by data presented in other chapters as appropriate, which includes field survey data and analysis of publicly available datasets as referenced in the relevant technical chapters. Those of relevance are listed below:

- Marine and coastal surveys relating to marine water quality as described in Volume 4 Environmental Report for UK Offshore - Chapter 13: Marine Water Quality;
- Data used to inform the baseline presented in Volume 4 Environmental Report for UK Offshore - Chapter 14: Biodiversity; and
- AIS data and wider shipping and fishing studies and risk assessments that informed Volume 4 Environmental Report for UK Offshore - Chapter 19: Shipping and Navigation and Chapter 20: Commercial Fisheries.

21.3 Methodology for Assessment of Effects

The methodology for assessing the vulnerability of the Project to foreseeable risks of major accidents and disasters and the potential for natural and man-made hazards to occur is guided by current good practice as defined by IEMA (2020). The approach that has been adopted is also aligned to the previously mentioned European guidance made available by the EC (European Union, 2017).

The noted guidance for major accidents and disasters recommends that the scope covers those factors that could impede the Project's activities and objectives and that may have adverse effects on receptors. The focus of the assessment is therefore to recognise significant risk arising from major accidents and disasters and leading to potential significant environmental effects, thereby building resilience into the Project and reducing its vulnerability to risk.

Major accidents and disasters are by their nature of high consequence (if they occur) and are 'unplanned' with the effects not part of the intended design, construction, or operational intent. The assessment of significant effects for major accidents and disasters focuses on the risk significance, the combination of the severity of harm (if they were realised), sensitivity of the receptor and likelihood rather than the magnitude of the change and sensitivity of the receptor only.

Risk tolerability for major accidents and disasters is defined based on a principle of eliminating intolerable risks and to ensure, particularly at engineering design stages, that any residual risks while small are further minimised where practicable. This principle has been applied in this assessment, with 'intolerable risk' interpreted as equivalent to 'significant adverse effects' to use terminology consistent with other topic assessments considered in this ER.

A significant adverse effect from major accidents and disasters is therefore one that would result in the following consequence, with a likelihood that the effect is considered intolerable to general society, based on commonly accepted benchmarks for what is intolerable:

- Serious damage to human populations – This includes harm which would be considered substantial (i.e. death(s)), multiple serious injuries or a substantial number requiring medical attention).
- Serious damage on the environment – Loss or significant detriment to populations of species or organisms, valued sites (including designated sites), valued cultural heritage sites, contamination of drinking water supplies, ground or groundwater, or harm to wider environmental receptors.

A significant effect could include both immediate and delayed effects. An immediate effect would be one that is self-evident at the time of the event such as damage to property or injury. A delayed effect is one that becomes evident only after time, such as loss of feeding ground leading to a change in the ecosystem.

In the planning stage, it is necessary for estimates to be qualitative and based on by expert judgement informed by comparison against experience in similar industries and for similar developments, where practical. After the Marine Licence is granted and as the design advances through further detailed engineering design stages, additional risk assessments (qualitative and where necessary quantitative) will be undertaken as part of the routine design process, to account for all emerging and relevant engineering details in the evolving design scheme.

The methodology for the assessment in this chapter follows a risk screening exercise:

- Identify the sources of potential major accidents and disasters arising from or affecting the Project;
- Identify potential receptors in the receiving environment and assess whether any credible pathways (or the link between an event and a receptor) exist. This is risk identification via a source-pathway-receptor model. Risks will then be screened out if no receptor is present, if no pathway exists, or the consequence will not constitute 'serious damage';
- For those risks that remain, qualitatively assess the harm/damage which could be caused to the receptor to estimate the magnitude of accidents and disasters (if they were realised), at the receptor;
- Qualitatively assess the likelihood of the effect, considering the range of impacts that may be associated with the source or initiator of an accident or disaster and taking into account the measures embedded in the Project that would reduce their occurrence or severity; and
- Establish whether significant (i.e. intolerable) effects from major accidents and disasters exists.

This chapter does not duplicate the assessment of risks that are already assessed in other ER chapters. For remaining risks, the likelihood of the hazard(s) will be defined. The severity of the consequence will then be defined, both before and after the implementation of risk management options (e.g. barriers, interventions, mitigations and controls and emergency response plans).

Where hazards causing a foreseeable risk of accidents or disasters are defined, the legislation, industry regulation or wider measures that can mitigate the risk are identified. The latter may include design factors, installation methods, management systems, and/or reliance upon emergency services. This approach intends to deliver a proportionate response to the requirements of the 2014 EIA Directive by setting out practical solutions and comprehensive controls for preventing, mitigating, and demonstrating preparedness and responsiveness to emergency situations that could arise as a result of the Celtic Interconnector Project.

This is achieved with reference to the receptors at risk of impacts from those hazards from the topic-specific baselines and risk-receptor pathways.

21.3.1 Significance Evaluation Criteria

A significant adverse effect for major accidents and disasters is focused on risk. This differs from the way in which many other topics are assessed. Typically, other topics examine effects that are considered likely to occur and therefore are unlikely to meet the thresholds required to be considered a major accident or a disaster.

This chapter considers reasonably foreseeable but unplanned events where the effects are not part of the intended design, installation or operational intent. By their nature, these are typically very infrequent but are important considerations so that resilience against them can be built into the Project at the planning stage, and to provide sufficient information for informed decisions to be made for planning purposes. Resilience is built by ensuring that high consequence events are eliminated or, where elimination is not possible, reduced to such an extent the chance of them occurring is so small that they can be deemed not to be significant.

Risk tolerability for people is well established in the UK. The primary references for this is the Health and Safety Executive's R2P2 document (Health and Safety Executive, 2001) and the guidelines published by the CDOIF (CDOIF, 2016). The R2P2 and CDOIF criteria have been referred to in this assessment to provide a consistent basis for the study against common benchmarks for major accidents and disasters applied across the UK. The following factors are important in defining risk tolerability criteria:

- Magnitude of change – the consequence thresholds of major accidents and disasters are established from the following dimensions and intrinsically account for receptor sensitivity and can be described as the severity of harm (a combination of extent and damage potential);
- Duration of harm (the recovery period) for non-human receptors or the numbers of people affected for human receptors; and
- Likelihood of the event occurring.

These combine to provide a measure of risk (i.e. the combination of the serious damage arising from a potential event and its likelihood of occurrence).

21.3.2 Magnitude of Change

In order to distinguish between potential events of differing severities, all potential major accidents and disasters are categorised into one of four magnitude of change categories: Low, Medium, High, and Very High. Any scenario that does not meet the criteria of a major accident or disaster is listed as Non-Major Accident Hazard (non-MAH) in relation to safety hazards, and as non-Major Accident to the Environment (non-MATTE) in relation to COMAH sites.

Magnitude of change within the context of major accidents and disasters is assessed from both the severity of the harm, and either the duration over which the receptor experiences harm or the number of people affected.

The criteria for severity of harm are developed for a range of non-human receptor types was extracted directly from the CDOIF guidance and further receptor types for human populations were established to align to HSE's R2P2.

Four categories of magnitude of change are considered:

- **Not Significant**: This level of harm is below the minimum threshold determined for a major accident or disaster in the CDOIF guidance and in R2P2.
- **Severe, Major, Catastrophic**: These represent increasing levels of damage or harm to populations or environmental receptors.

For non-human receptor types, four categories of duration are considered: **Short, Medium, Long, and Very long term**.

The combination of harm severity and harm duration for non-human receptors is then used to determine magnitude of change.

The major accident thresholds based upon severity of harm used in this ER are presented in Table.

Table 21.3 Severity of harm criteria

Receptor	Non-Major Accident	Major Accident Threshold
Human populations (public)	Small number of minor injuries	Substantial number of people requiring medical attention. Events of this magnitude may also involve some damage to housing, with low numbers of people being displaced. Potential for localised interruption to utilities and damage to infrastructure.
Human populations (workers)	Accidents below the major accident threshold (e.g. several workers requiring medical attention)	Multiple life changing injuries to workers or any number of fatalities
Marine[19] (Typically includes coastal and transitional water bodies although not directly relevant to the Project in the UK EEZ)	<2ha littoral or sub-littoral zone, <100ha of open sea benthic community, <100 dead sea birds (<500 gulls), <5 dead / significantly impaired sea mammals	Severe impacts over 2-20ha littoral or sub-littoral zone, or 100-1,000ha of open sea benthic community. Alternatively, 100-1,000 dead sea birds (500-5,000 gulls), or

[19] Criteria extracted directly from CDOIF Guidance Criteria (CDOIF, 2016)

Receptor	Non-Major Accident	Major Accident Threshold
		5-50 dead / significantly impaired sea mammals. Harm which takes >1 year to recover.
Marine	Contamination that does not prevent fishing or aquaculture and that does not render it inaccessible to the public	Contamination of aquatic habitat (freshwater or marine) which prevents fishing or aquaculture or renders it inaccessible to the public

21.3.3 Determination of Significance

When the credible worst-case severity of the potential major accidents has been determined, if this severity exceeds the level which is considered a major accident given in Table 21.2, then a magnitude of change has been assigned. For each potential major accident or disaster which has a magnitude of change, a qualitative assessment of the likelihood is undertaken to determine whether the risk has been or will be reduced as low as reasonably practicable based upon the embedded mitigation.

21.4 Limitations

The assessment is based upon some assumptions regarding the use of vessels by the Project. An engineering, procurement and construction (EPC) contractor has not yet been engaged to undertake the installation of the Project, so it is possible that the number of vessels and the vessel types used will vary to some degree to those referred to in the assessment. However, a precautionary approach has been undertaken whereby a realistic worst-case is assumed. These limitations do not affect the mitigation measures which will be applied to the installation vessels and installation process. The selection of vessels and a contractor will have due regard to good practice in the use of these vessels and the approach to installation.

There are no further limitations relating to major accidents and disasters that affect the robustness of the assessment of the likely significant effects of the Project.

21.5 Receiving Environment

The baseline receiving environment for major accidents and disasters varies depending on the type and scale of the event in question. The scope of this chapter is determined by the nature of the potential major accidents which could be associated with this project. It is focused upon the movement of vessels and navigational risk, as well as the use of plant and machinery in the foreshore area with associated risks to water quality and biodiversity from accidental leaks and spills.

A thorough description of the relevant baseline receiving environment is therefore presented in Volume 4 Environmental Report for UK Offshore - Chapter 13: Marine Water Quality, Chapter 14: Biodiversity, and Chapter 19: Shipping and Navigation. The findings of those chapters are not reproduced here, but this chapter should be read in conjunction with and with reference to those chapters. Reference is also made in this chapter to the data and information presented Volume 4 Environmental Report for UK Offshore - Chapter 5: Project Description.

It is not considered that there is any additional baseline information required to inform the assessment of major accidents and disasters.

The receptors to the navigational risk hazard identified are those sea users defined in Volume 4 Environmental Report for UK Offshore - Chapter 9: Population and Human Health, Chapter 19: Shipping and Navigation and Chapter 20: Commercial Fishing. These include commercial shipping activities such as ferry operators and marine freight haulage, as well as the operators of fishing vessels.

The ecological receptors to the risk associated with accidental spills are the species groups identified in Volume 4 Environmental Report for UK Offshore – Chapter 14: Biodiversity, which includes benthos, fish, birds, and marine mammals. Volume 11 HRA for UK Offshore identified that there is no potential for significant effects on the conservation objectives on European sites designated by the UK. All those identified for screening have been excluded for the Celtic Interconnector Project alone and in-combination with other plans and projects. There are therefore no Natura 2000 sites relevant to this chapter.

21.6 Characteristics of the Development

The Project has been reviewed and potential sources of major accidents have been identified at key locations in the project.

21.6.1 Cable Route

The characteristics of the development that have the potential to result in a major accident during the installation of the offshore cable are:

- Movement of vessels during offshore cable installation works, notably the offshore cable lay, which may create a potential navigational hazard by increasing the risk of vessel collisions affecting other sea users;
- Use of plant and machinery in the marine environment, which may result in a risk of accidental spills of fuel and lubricants in the marine environment with the potential for direct effects on water quality and consequences for ecological receptors, marine habitats, and nature conservation designations (noting that the interconnector cable route does not intersect any nature conservation designations); and
- There is a risk that the Celtic Interconnector cable could be damaged by anchor dragging or emergency anchoring or foundering in the vicinity of the cable. The likelihood of this is low considering that the cable will be buried to an appropriate depth and adequately protected where required. It is not considered credible that the cable poses a serious risk of major accident to other sea users, but the economic consequence for the project could be severe. As there is no credible major accident hazard associated with this scenario, it has been discounted from further analysis.

21.6.2 Cable Protection

The Celtic Interconnector cable in the UK EEZ will be protected through burial wherever possible, with external protection installed where trenching is not feasible (i.e. due to the presence of hard rock or seabed obstacles that could not be cleared) or as remedial secondary protection where the target depth of lowering (DOL) cannot be achieved. External protection will not be used as primary protection along the cable route in the UK EEZ. Some secondary rock protection may be required in the UK EEZ however, where the target DOL is not achieved. The worst-case scenario for secondary protection in the UK EEZ is between 0km and 80km as a total length of cable coverage, 0t to 270t as a volume of installed rock.

21.7 Sources of Disasters

Disasters are by their nature external hazards that could be caused by Project activities or that could affect the Project. Either situation could result in impacts on third party receptors. Once operational, the Project does not have a permanent or fixed workforce that could be considered a receptor. Therefore, the consideration of disaster hazards impacting the project is limited to the installation personnel who would be present during this phase of the Project.

Given the location of the offshore installation of the cable route into the UK EEZ, the disaster hazards that could credibly occur during the installation and operation of the Project relate to severe meteorological and hydrological conditions. These are commonly inter-related and are most likely to involve high winds, storm surges and high significant wave action. These are considered to be causal factors, meaning that they do not directly cause accidents, but they do increase the risk or likelihood of accidents occurring.

Hazards of this nature are unavoidable when working in an offshore environment. The Project is designed to account for hazards of this type, and it will be factored into the approach taken by the installation contractor. As the offshore installation sequencing is programmed to occur during the summer months, the likelihood of storms and associated extreme conditions is minimised. In line with the Project-wide Health and Safety Plan, offshore installation and monitoring works during the operational phase of the Project would not occur during storm conditions.

21.8 Likely Significant Impacts of the Development

21.8.1 Do Nothing

In the ‘Do Nothing’ scenario, there will be no offshore activities in the UK EEZ relating to the Project so there will be no associated risk of navigational hazard to commercial shipping operators or commercial fishing vessels.

21.8.2 Installation Phase

The movement of cable installation vessels during offshore cable installation works, notably the cable laying activities in the offshore environment has the potential to create a navigational hazard that could result in vessel collisions.

While the likelihood of the risk is low given that safe navigational practices will be a Project requirement, vessel collisions have the potential to result in injury and fatality to other sea users and the offshore project workforce. The likelihood and severity of this risk are assessed in the Navigational Risk Assessment (NRA) presented in Volume 4 Environmental Report for UK Offshore – Chapter 19: Shipping and Navigation. In line with the methodology described in this chapter, the NRA is not duplicated here.

The use of plant and machinery during the installation of the Project creates a risk of accidental spills of fuel and lubricants in the foreshore or marine environment with the potential for direct effects on localised water quality. The magnitude of change from such an event is negligible, in line with the severity of harm criteria presented in Table 21.2.

The Project will adopt all appropriate good practice measures for site management in line with the requirements of the Management of Health and Safety at Work Regulations 1999 (S.I. 1999/3242) and the Control of Major Accident Hazards Regulations 2015 (S.I. 2005/1643). This will be ensured through the appointment of a Project Supervisor and binding commitments in the Construction Environmental Management Plan (CEMP), which will ensure that any potential environmental impacts are risk assessed and appropriate mitigation provided. Mitigation for minimising the likelihood of leaks and spills is also embedded into Project design through the use of good practice site management, spill contingency and emergency response plans in line with the CEMP. and relevant UK regulations as noted above.

Specifically, in relation to fuels and lubricant oils, the risk assessment will minimise the inventory used and seek to use less hazardous alternatives where practicable to do so. Other measures such as bunding and spill kits will be provided to allow containment and timely clean-up of any accidental leaks and spills. Personnel will be trained in the correct implementation of such arrangements and emergency plans will be in place to enable unforeseen events to be responded to quickly and effectively. This will prevent any spillages from disseminating into the environment.

As a result of the embedded mitigation, the risk to human health and the environment will be reduced as low as is reasonably practicable.

There is an inherent safety risk to the workforce of any construction project, which cannot be eliminated but can be suitably managed. The risk to workers on-site from the use of plant and machinery and the possibility of slips, trips and falls is covered by the project-wide Health and Safety Plan in addition to the measures described above relating to site management. All workers on-site will be required to wear appropriate Personal Protective Equipment (PPE) in line with the requirements of the Personal Protective Equipment (Enforcement) Regulations 2018. This will reduce the likelihood of serious harm to workers and meet the expectations of good practice for the construction industry. The risk of harm to workers is therefore assessed as not significant.

The use of plant and machinery on and near the foreshore creates a risk of accidental spills of fuel and lubricants in the foreshore or marine environment with the potential for effects on ecological receptors such as coastal species, habitats and nature conservation designations. Given the measures described above and the consequentially low volumes of pollutants that could be released into the environment, the area of estuarine or marine water at risk is considerably lower than 2ha, which is the major accident threshold defined in Table 21.2 for the severity of harm. Given the worst-case credible consequence is not considered a major accident, the magnitude of change is non-MAH and it is therefore assessed as not significant.

21.8.3 Operational Phase

During the operational phase, some periodic vessel movements will occur in the UK EEZ to enable the integrity of the cable burial and cable protection to be monitored. The necessary frequency of this monitoring is not yet known, but the presence of monitoring vessels has the potential to create a navigational hazard that could result in a risk of a vessel collision. As described for the installation phase, the likelihood and severity of this risk are assessed in the Navigational Risk Assessment (NRA) presented in Volume 4 Environmental Report for UK Offshore - Chapter 19: Shipping and Navigation. In line with the methodology described in this chapter, the NRA is not duplicated here.

21.8.4 Decommissioning Phase

It is currently anticipated that the Celtic Interconnector cable in the UK EEZ will be left in-situ upon decommissioning. Routine surveys will be undertaken to assess the status and safety of the decommissioned infrastructure. In this scenario, the potential for major accidents would be comparable with those described during the installation phase. Given the conclusions drawn above, there are no significant impacts anticipated as a result of the low magnitude of change, and the low likelihood of the occurrences defined.

In the event that any part of the Project is removed from the UK marine environment upon decommissioning, any associated risk of major accidents would be managed through a CEMP by the EPC contractor in line with relevant legislation and guidance at that time.

21.8.5 Cumulative Effects

There are no projects identified in the vicinity of the Project in the UK EEZ that could give rise to cumulative effects. There is therefore no potential for cumulative effects in relation to major accidents and disasters.

21.8.6 Mitigation and Monitoring Measures

Commented [A65]: Placeholder: All mitigation measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

The embedded mitigation in place relates to the effective management of navigational safety (Volume 4 Environmental Report for UK Offshore - Chapter 19: Shipping and Navigation) as well as through emergency planning and the on-site and on-board management of leaks and spills. The risks identified, and therefore the necessary mitigation, applies throughout all phases of the Project (installation, operation, decommissioning). To avoid duplication, the mitigation in this section is applicable to all phases of the Project.

Risk to workers from on-site accidents such as slips, trips and falls as well as from exposure to chemicals such as fuels and lubricants is reduced to as low as reasonably possible (ALARP) through a Project-wide requirement for all on-site and on-board personnel to be supplied with and to wear the appropriate PPE in line with the requirements of the Personal Protective Equipment (Enforcement) Regulations 2018. Risk to the marine environment and to the public from exposure to contaminants is reduced to ALARP through the prevention of leaks and spills being released into the environment. This is achieved through on-site and on-board good practice in line with the COMAH Regulations and the International Convention for the Prevention of Pollution from Ships (MARPOL) Convention.

The risk of major accidents and disasters from the Celtic Interconnector Project in the UK marine environment is reduced to ALARP. A hazard identification record that summarises the findings of this assessment is presented in Table 21.2.

Table 21.2 Hazard identification record

Risk event	Source	Pathways	Receptor	Reasonable worst consequence if event did occur	Likely cross-disciplinary impacts	Mitigation	Magnitude of change	Is reasonable worst consequence managed to an acceptable level?
Movement of cable installation vessels	Vessel presence in offshore waters that are navigated by other sea users	Navigational hazard creating a risk of vessel collision	Other sea users Construction or maintenance workforce	Vessel collision with potential for loss of property, injury or loss or life	Population and human health Shipping navigation Commercial fisheries	Risks managed through installation planning, adherence to navigational best practice, issue of Notice to Mariners, and use navigational markers (Volume 4 Environmental Report for UK Offshore - Chapter 19: Shipping and Navigation).	Above Major Accident Threshold	Yes

Risk event	Source	Pathways	Receptor	Reasonable worst consequence if event did occur	Likely cross-disciplinary impacts	Mitigation	Magnitude of change	Is reasonable worst consequence managed to an acceptable level?
Use of plant and machinery in the marine environment	Accidental leak or spill of fuel or lubricants during use of plant and machinery	Dependent on spill location – most likely pathway is spill directly onto beach draining to the receptor.	Marine species (benthos, fish, birds, and marine mammals)	Direct toxicity effects of pollutants through bioaccumulation in the food chain or direct physical contamination	Biodiversity	Construction and site management good practice including CEMP, adherence to the International Convention for the Prevention of Pollution from Ships (MARPOL), and CEMP. These will limit the likelihood and size of leaks or spills and provide measures to contain accidental	Non-MATTE	Yes

Risk event	Source	Pathways	Receptor	Reasonable worst consequence if event did occur	Likely cross-disciplinary impacts	Mitigation	Magnitude of change	Is reasonable worst consequence managed to an acceptable level?
						releases such that they cannot discharge into the environment.		
	Accident involving plant or machinery	Direct	Construction or maintenance workforce	Direct physical effects leading to injury or loss of life	Population and human health	Good HSE practice on-board in line with Management of Health and Safety at Work Regulations 1999 (S.I. 1999/3242), the Control of Major Accident Hazards Regulations 2015 (S.I.	Non-MAH	Yes

Risk event	Source	Pathways	Receptor	Reasonable worst consequence if event did occur	Likely cross-disciplinary impacts	Mitigation	Magnitude of change	Is reasonable worst consequence managed to an acceptable level?
						2005/1643), and the Personal Protective Equipment (Enforcement) Regulations 2018		
Extreme weather or storm conditions	Hazardous offshore working conditions	Extreme weather causing navigational accidents	Offshore personnel	Navigational accident with potential for loss of property, injury or loss or life	Population and human health Shipping navigation	Offshore works will not typically be undertaken in storm conditions above sea state 3. Safety measures onboard vessels and the adequate training of crew will minimize risk to personnel.	Non-MAH	Yes

21.9 References

CDOIF, 2016. Chemical and Downstream Oil Industries Forum. Guideline - Environmental Risk Tolerability for COMAH Establishments Rev 2. Online [Accessed January 2021] https://www.sepa.org.uk/media/219154/cdoif_guideline_environmental_risk_assessment_v2.pdf

DETR, 1999. Guidance on the Interpretation of Major Accidents to the environment for the purposes of COMAH Regulations. Department of the Environment, Transport and the Regions (DETR) Online [Accessed January 2021] https://www.sepa.org.uk/media/219153/detr-guidance-1999.pdf

Energy Institute (EI), (2017), "Guide to predicting environmental recovery durations from major accidents. Supporting guide to the Environmental risk tolerability for COMAH establishments guideline"

European Commission, 2017. Environmental Impact Assessment of Projects, Guidance on Scoping. Online [Accessed January 2021] https://ec.europa.eu/environment/eia/pdf/EIA_guidance_Scoping_final.pdf

European Union 2017. Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU). Online [Accessed January 2021] https://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf

Health and Safety Executive, 2001. Reducing Risks, Protecting People, HSE's decision-making process.

IEMA, 2020. Major Accidents and Disasters in EIA: A Primer. Online https://www.iema.net/resources/blog/2020/09/23/iema-major-accidents-and-disasters-in-eia-primer [Accessed November 2020]

22 Summary of Monitoring and Mitigation

Commented [A66]: Placeholder for summary chapter

Appendix A
MMO Screening Opinion

Marine
Management
Organisation

Lancaster House
Hampshire Court
Newcastle upon Tyne
NE4 7YH

T 0300 123 1032
F 0191 376 2681
www.gov.uk/mmo

Eoghan Tuite
Offshore Project Manager, Celtic Interconnector Project, EIRGRID PLC
EirGrid plc
Block 2, The Oval,
160 Shelbourne Road,
Dublin 4,
D04 FW28,
Ireland
&
Réseau de Transport d'Électricité (RTE),
Immeuble Window,
7C Place du Dome,
92073 Paris La Defense Cedex,
France
D04 FW28

Case reference: EIA/2020/00042

17th December 2020

Dear Mr Eoghan Tuite,

The Marine Works (Environmental Impact Assessment) Regulations 2007, as amended ("the Regulations")
Request for a screening opinion - Celtic Interconnector Project

Thank you for your application dated 03 November 2020, requesting a formal screening opinion from the Marine Management Organisation (MMO) in respect to the Celtic Interconnector Project.

Background

It is our normal procedure to consider such applications in compliance with our obligations under the Regulations.

In considering these Regulations, the MMO must determine whether the works envisaged are a project listed in Schedule A1 (for which an Environmental Impact Assessment (EIA) is mandatory) or a Schedule A2 project within the Marine Works Regulations ("MWRs").

On reviewing the information you supplied, I am of the opinion that the works proposed do not constitute a project listed in either Schedule A1 or Schedule A2 of the MWRs. Please see the attached document for the MMO's consideration of the project.

Marine Management Organisation

Lancaster House
Hampshire Court
Newcastle upon Tyne
NE4 7YH

T 0300 123 1032
F 0191 376 2681
www.gov.uk/mmo

Your feedback

We are committed to providing excellent customer service and continually improving our standards and we would be delighted to know what you thought of the service you have received from us. Please help us by taking a few minutes to complete the following short survey (https://www.surveymonkey.com/r/MMOMLcustomer).

Finally, If you have any queries or require clarification on any of the above, then please do not hesitate to contact me.

Yours sincerely

Validity unknown
Digitally signed by Marine Licensing
Date: 2020.12.17 14:51:28 GMT
Reason: On behalf of the Secretary of State
Location:

Mrs Emma Dowson
+44 (0)20789 55501
emma.dowson@marinemanagement.org.uk

INVESTORS IN PEOPLE

Appendix B
Letter Defining Information Required under Article 10(4)(a) of TEN-E Regulation

Marine Management Organisation

Marine Licensing
Lancaster House
Hampshire Court
Newcastle Upon Tyne
NE4 7YH

T +44 (0)300 123 1032
F +44 (0)191 376 2681
www.gov.uk/mmo

Ms Valerie Brennan,
EirGrid.

Cc.
Mr Eoghan Tuite, EirGrid.
Gaëlle Chevreau, RTE.
(By e-mail only)

Our reference:
ENQ/2019/00160

10 September 2020

Dear Ms Brennan,

Celtic Interconnector – Roles, Responsibilities and Requirements

The following document outlines the roles, responsibilities and requirements at three key stages (Draft Application File; Application; and Comprehensive Decision) of the TEN-E Regulation process for Celtic Interconnector (the Promoter) and the Marine Management Organisation (MMO) (the marine determining authority and National Competent Authority).

The letter has been drafted in accordance with Article 10(4)(a) of the TEN-E Regulation, stipulating the scope of material and level of detail of information to be submitted by the project promoter, as part of the application file processes.

Should any other further topics, not identified in this letter, be identified during any future pre-application discussions, then they will also need to be included in the draft application file.

1. Draft Application File

If there are any documents missing that have been requested below or if any documents are lacking sufficient detail the MMO will notify the Promoter within one month of the submission of the Draft Application File and will send an application update request via a letter.

1.1. Marine Licence Draft Application to Marine Management Organisation

The Promoter must submit a draft application via the MMO's Marine Licensing Case Management System.

The draft application must include:

ENVIRONMENT ISO 14001 CERTIFIED
QUALITY ISO 9001 CERTIFIED
INVESTORS IN PEOPLE | Bronze

1. A Marine Licence application form, including but not limited to: a project description, a worst-case scenario methodology, site coordinates, previous correspondence with the MMO, other applications / consents and signposts to documents considering the relevant plans and policies, consideration of the Marine Strategy Framework Directive, any Habitat Regulation Assessment, Marine Conservation Zone Assessment, or other assessment undertaken.
2. Relevant offshore survey reports (in whole or part) for geophysical, geotechnical, archaeological interpretation, benthic and any other survey reports the Promoter considers relevant.
3. Offshore Consultation Report summarising the consultation undertaken during the pre-application phase.
4. Environmental Report, including a non-technical summary and associated technical reports demonstrating the outcome of the assessments undertaken for the offshore elements of the project to consider but not limited to the following topics:
    a. Planning policy and legislative framework
    b. Development, cable route selection and alternatives
    c. Project description
    d. Physical conditions and marine processes
    e. Benthic ecology
    f. Fish and shellfish
    g. Marine birds
    h. Marine mammals and reptiles
    i. Protected sites
    j. Commercial fisheries
    k. Shipping and navigation
    l. Offshore infrastructure and other sea users
    m. Recreation
    n. Marine archaeology
    o. Cumulative effects
    p. Proposed mitigation measures

2. <u>Final Application File</u>

In the event that any of the information set out in Section 1 of this correspondence is missing, within one month of the submission of the draft application file the MMO will issue a letter to the Promoter summarising the missing information and request that this is provided via the appropriate method.

2.1. <u>Confirmation of Final Application File</u>

Page **2** of **3**

Within three months of the submission of the Draft Application File or the submission of all of the missing information, the Promoter must submit the Final Application File via CD to the MMO.

Once the MMO receive the Final Application File the MMO will confirm the formal start of the 18 month permit granting process under the TEN-E Regulation.

3. **Comprehensive Decision**

Once a marine licence and full planning permissions have been granted, the MMO will issue a letter to the Promoter stating that the statutory permit granting process has been completed and that these comprise the comprehensive decision for the purposes of the TEN-E Regulation.

If you have any queries regarding this correspondence, please do not hesitate to contact myself or the Case Manager, Abbey Coppin.

Yours sincerely,

EDowson

Emma Dowson
Marine Licensing Case Officer
D +44 (0) 20 789 55501
E Emma.Dowson@marinemanagement.org.uk