The Great Grid Upgrade

Sea Link

Sea Link

Volume 6: Environmental Statement

Document: 6.2.4.2
Part 4 Marine
Chapter 2
Benthic Ecology

Planning Inspectorate Reference: EN020026

Version: C
November 2025

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 Regulation 5(2)(a)

nationalgrid

Page intentionally blank

Contents

Table of Tables

Version History

Date	Issue	Status	Description / Changes
March 2025	A	Final	For DCO submission
May 2025	B	Final	Amended text based on s51 Advice
November 2025	C	Final	Amended following Relevant Representations for Deadline 1

2. Benthic Ecology

2.1 Introduction

2.1.1 This chapter of the Environmental Statement (ES) presents information about the environmental assessment of the likely significant benthic ecological effects that could result from the Proposed Project (as described in **Application Document 6.2.1.4 Description of the Proposed Project**).

2.1.2 This chapter describes the methodology used, the datasets that have informed the environmental assessment, baseline conditions, mitigation measures and benthic ecological residual significant effects that could result from the Proposed Project.

2.1.3 The Order Limits, which illustrate the boundary of the Proposed Project, are illustrated on **Application Document 2.2.1 Overall Location Plan**.

2.1.4 This chapter should be read in conjunction with:

- **Application Document 5.1 Consultation Report;**
- **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project;**
- **Application Document 6.2.1.5 Part 1 EIA Introduction Chapter 5 Approach and Methodology;**
- **Application Document 6.2.1.6 Part 1 Introduction Chapter 6 Scoping Opinion and EIA Consultation;**
- **Application Document 6.2.2.3 Part 2 Suffolk Chapter 3 Ecology and Biodiversity;**
- **Application Document 6.2.3.3 Part 2 Kent Chapter 3 Ecology and Biodiversity**;
- **Application Document 6.2.4.1 Part 4 Marine Chapter 1 Physical Environment**;
- **Application Document 6.2.4.3 Part 4 Marine Chapter 3 Fish and Shellfish**;
- **Application Document 6.2.4.4 Part 4 Marine Chapter 4 Marine Mammals**;
- **Application Document 6.2.4.5 Part 4 Marine Chapter 5 Marine Ornithology**;
- **Application Document 6.2.4.8 Part 4 Marine Chapter 8 Commercial Fisheries**;
- **Application Document 6.2.4.11 Part 4 Marine Chapter 11 Inter-Project Cumulative Effects**;
- **Application Document 6.6 Habitats Regulations Assessment Report**;
- **Application Document 6.11 Marine Conservation Zone Assessment**;
- **Application Document 6.12 Environmental Gain Report**;
- **Application Document 7.5.2 Outline Offshore Construction Environmental Management Plan**;

- **Application Document 7.5.3.1 CEMP Appendix A Outline Code of Construction Practice**;
- **Application Document 7.5.3.2 CEMP Appendix B Register of Environmental Actions and Commitments (REAC)**;
- **Application Document 7.7 Marine Biosecurity Plan**;
- **Application Document 7.5.12 Outline Offshore Invasive Non-Native Species Management Plan**; and
- **Application Document 8.1 Historic Report 1 Sea Link Corridor and Preliminary Routing and Siting Study (CPRSS)**.

2.1.5 This chapter is supported by the following figures:

- **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**.

2.1.6 This chapter is supported by the following appendices:

- **Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)**;
- **Application Document 6.3.4.2.B Appendix 4.2.B Geophysical Survey Interpretation (Additional Surveys)**;
- **Application Document 6.3.4.2.C Appendix 4.2.C Intertidal Survey Report**;
- **Application Document 6.3.4.2.D Appendix 4.2.D Interim Subtidal Survey Report (Additional Surveys)**; and
- **Application Document 6.5 Electric and Magnetic Field Compliance Report**.

2.2 Regulatory and Planning Context

2.2.1 This section sets out the legislation and planning policy that is relevant to the benthic ecology assessment. A full review of compliance with relevant national and local planning policy is provided within the Planning Statement submitted as part of the application for Development Consent.

2.2.2 Policy generally seeks to minimise benthic effects from development and to avoid significant adverse effects. This applies particularly to where project activities have the potential to interfere with protection and conservation initiatives for local populations, and species/habitats of conservation importance.

Legislation

Marine and Coastal Access Act 2009

2.2.3 The Marine and Coastal Access Act (2009) is the legal mechanism to help ensure clean, healthy, safe, and productive and biologically diverse oceans and seas.

The Conservation of Habitats and Species Regulations 2017 (amended 2019)

2.2.4 The Conservation of Habitats and Species Regulations (2017a) (amended 2019[1]) transposes the Habitats Directive (92/43/EEC) and implements provisions from the Birds Directive (2009/147/EC), into UK legislation. These regulations cover the requirements to protect sites that are internationally important for threatened habitats and species out to the 12 nautical mile (NM) limit.

The Conservation of Offshore Marine Habitats and Species Regulations 2017

2.2.5 The Conservation of Offshore Marine Habitats and Species Regulations (2017b) covers the requirements to protect sites that are internationally important for marine habitats and species within the UK Offshore Marine Area (beyond the 12 NM limit).

The Wildlife and Countryside Act 1981

2.2.6 The Wildlife and Countryside Act (1981) (as amended) includes provisions relating to nature conservation, including marine habitats and species.

The Marine Strategy Regulations 2010

2.2.7 The Marine Strategy Regulations (2010) transposes the Marine Strategy Framework Directive (2008/56/EC) into UK legislation as retained law from the European Union. The regulations requires that developments do not hinder the achievement of good environmental status of the seas.

The Water Environment (Water Framework Directive (England and Wales)) Regulations 2017

2.2.8 The Water Environment (Water Framework Directive (England and Wales)) Regulations (2017c) transposes the EU Water Framework Directive (2000/60/EC) into UK legislation as retained law from the European Union. These regulations require that developments do not contribute to the deterioration of aquatic ecosystems.

Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006

2.2.9 Section 41 of the NERC Act (2006) imposes a requirement on the Secretary of State to publish a list species of principal importance for the purpose of conservation of biodiversity.

Environment Act 2021

2.2.10 The Environment Act 2021 sets clear statutory targets for the recovery of the natural world in four priority areas: air quality, biodiversity, water, and waste, and includes the introduction of Biodiversity Net Gain (BNG).

[1] Amended in response to the UK's exit from the European Union (EU), making the Habitats (92/43/EEC) and Wild Birds (2009/147/EC) Directives, operable from 1 January 2021, and creating a UK natural site network in place of the EU Natura 2000 ecological network.

National Policy

National Policy Statements

2.2.11 National Policy Statements (NPS) set out the primary policy tests against which the application for a Development Consent Order (DCO) for the Proposed Project would be considered. Table 2.1, Table 2.2 and Table 2.3 below provides details of the elements of NPS for Energy (EN-1) (DECC, 2024a) NPS for Renewable Energy Infrastructure (EN-3) (DECC, 2024b) and NPS for Electricity Networks Infrastructure (EN-5) (DECC, 2024c) that are relevant to this chapter.

Table 2.1 NPS EN-1 requirements relevant to benthic ecology

NPS EN-1 section	Where this is covered in the ES
4.5.7…"*Applicants are encouraged to approach the marine licensing regulator (MMO in England and Natural Resources Wales in Wales) in pre-application, to ensure that they are aware of any needs for additional marine licenses alongside their Development Consent Order application*".	Consultation with the MMO was undertaken during the scoping stage and through statutory consultation and engagement is ongoing. Relevant comments are provided in Section 2.3.
4.5.8…"*Applicants for a Development Consent Order must take account of any relevant Marine Plans and are expected to complete a Marine Plan assessment as part of their project development, using this information to support an application for development consent*".	Relevant Marine Plans are identified in Table 2.5 and considered in Section 2.9 and assessed in **Application Document 6.13 Marine Plan Policy Assessment**.
4.5.9…"*Applicants are encouraged to refer to Marine Plans at an early stage, such as in pre-application, to inform project planning, for example to avoid less favourable locations as a result of other uses or environmental constraints".*	Relevant Marine Plans are identified in Table 2.5 and considered in Section 2.9. Further detail on the routing is considered in **Application Document 6.2.1.3 Part 1 Introduction Chapter 3 Main Alternatives Considered**.
5.4.17…*"Where the development is subject to EIA, the applicant should ensure that the ES clearly sets out any effects on internationally, nationally, and locally designated sites of ecological or geological conservation importance (including those outside England), on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity, including irreplaceable habitats".*	Details of designated sites and protected species, and other habitats and species of principal importance are provided in Section 2.7 and an assessment of impacts can be found in section 2.9. An assessment of impacts on designated sites is available in the HRA and MCZ Assessment (**Application Document 6.6 Habitats Regulations Assessment Report**; **Application Document 6.11 Marine Conservation Zone Assessment**).
5.4.18…*"The applicant should provide environmental information proportionate to the infrastructure where EIA is not required to help the*	Relevant mitigation measures identified at are provided in Section 2.8.

NPS EN-1 section	Where this is covered in the ES
Secretary of State consider thoroughly the potential effects of a proposed project".	
5.4.19…*"The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests".*	The project will adopt a range of measures to conserve and enhance biodiversity as detailed in Section 2.8.
5.4.35…"*Applicants should include appropriate avoidance, mitigation, compensation and enhancement measures as an integral part of the proposed development*".	Relevant mitigation measures identified are provided in Section 2.8.

Table 2.2 NPS EN-3 requirements relevant to benthic ecology

NPS EN-3 section	Where this is covered in the ES
3.8.115…*"Applicants must undertake a detailed assessment of the offshore ecological, biodiversity and physical impacts of their proposed development, for all phases of the lifespan of that development, in accordance with the appropriate policy for offshore wind farm EIAs, HRAs and MCZ assessments"*	A baseline of subtidal benthic ecology is provided in Section 2.7 and an assessment of impacts can be found in Section 2.9. An assessment of impacts on designated sites is available in the HRA and MCZ Assessment (**Application Document 6.6 Habitats Regulations Assessment Report**; **Application Document 6.11 Marine Conservation Zone Assessment**).
3.8.118…"Applicants should consult at an early stage of pre-application with relevant statutory consultees and energy not-for profit organisations, as appropriate, on the assessment methodologies, baseline data collection, and potential avoidance, mitigation and compensation options which should be undertaken".	Consultation with the statutory consultees, including the Marine Management Organisation and Natural England, was undertaken during the scoping stage and during the Preliminary Environmental Impact Report (PEIR) stage. Relevant comments are provided in Section 2.3.
3.8.138…"Applicant assessment of the effects of installing across the intertidal/coastal zone should demonstrate compliance with mitigation measures identified by The Crown Estate in any plan-level HRA produced as part of its leasing round, and include information, where relevant, about: • any alternative landfall sites that have been considered by the applicant during the design phase and an explanation for the final choice; • any alternative cable installation methods that have been considered by the applicant during the design phase and an explanation for the final choice; • potential loss of	A baseline of intertidal habitats is provided in Section 2.7 and an assessment of impacts can be found in Section 2.9. An assessment of impacts on designated sites is available in the HRA and MCZ Assessment (**Application Document 6.6 Habitats Regulations Assessment Report**; **Application Document 6.11 Marine Conservation Zone Assessment**).

NPS EN-3 section	Where this is covered in the ES
habitat; • disturbance during cable installation, maintenance/repairs and removal (decommissioning); • increased suspended sediment loads in the intertidal zone during installation and maintenance/repairs; • potential risk from invasive and non-native species; • predicted rates at which the intertidal zone might recover from temporary effects, based on existing monitoring data; and • protected sites".	
3.8.116…Applicant assessment of the effects on the subtidal environment should include: • loss of habitat due to foundation type including associated seabed preparation, predicted scour, scour protection and altered sedimentary processes, e.g. sand wave/boulder/UXO clearance; • environmental appraisal of inter-array and other offshore transmission and installation/maintenance methods, including predicted loss of habitat due to predicted scour and scour/cable protection /boulder/UXO clearance; • habitat disturbance from construction and maintenance/repair vessels' extendable legs and anchors;• increased suspended sediment loads during construction and from maintenance/repairs; • predicted rates at which the subtidal zone might recover from temporary effects; • potential impacts from EMF on benthic fauna; • potential impacts upon natural ecosystem functioning; • protected sites; and • potential for invasive/non-native species introduction".	A baseline for benthic ecological receptors is provided in Section 2.7 and an assessment of impacts can be found in Section 2.9. For details regarding impacts associated with fish and shellfish, marine mammals, and marine ornithology, see **Application Document 6.2.4.3 Part 4 Marine Chapter 3 Fish and Shellfish**; **Application Document 6.2.4.4 Part 4 Marine Chapter 4 Marine Mammals**; and **Application Document 6.2.4.5 Part 4 Marine Chapter 5 Marine Ornithology**, respectively.

Table 2.3 NPS EN-5 requirements relevant to benthic ecology

NPS EN-5 section	Where this is covered in the ES
2.2.10 "...*As well as having duties under Section 9 of the Electricity Act 1989, (in relation to developing and maintaining an economical and efficient network), applicants must take into account Schedule 9 to the Electricity Act 1989, which places a duty on all transmission and distribution licence holders, in formulating proposals for new electricity networks infrastructure, to "have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest … and …do what [they] reasonably can to mitigate any effect which the proposals would have on the natural*	National Grid undertook a detailed routing and siting study (**Application Document 8.1 Historic Report 1 (CPRSS)** which considered a wide range of environmental factors including features of special interest. Relevant mitigation measures identified at this stage are provided in Section 2.8.

NPS EN-5 section	Where this is covered in the ES
beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects".	
2.13.15 *"…The sensitivities of many coastal locations and of the marine environment as well as the potential environmental, community and other impacts in neighbouring onshore areas must be considered in the identification onshore connection points."*	Landfall design is summarised in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**. Other mitigation relevant to benthic ecology is provided in Section 2.8.
2.14.2...(Part) "*In the assessments of their designs, applicants should demonstrate how environmental, community and other impacts have been considered and how adverse impacts have followed the mitigation hierarchy i.e. avoidance, reduction and mitigation of adverse impacts through good design; how the mitigation hierarchy has been followed, in particular to avoid the need for compensatory measures for coastal, inshore and offshore developments affecting SACs SPAs, and Ramsar sites".*	Mitigation, embedded measures, and control and management measure to minimise environmental impacts to benthic ecology are discussed in Section 2.8. Cumulative effects are assessed in **Application Document 6.2.4.11 Part 4 Marine Chapter 11 Inter-Project Cumulative Effects.**

National Planning Policy Framework

2.2.12 The National Planning Policy Framework (NPPF), as revised in December 2024 (Ministry for Levelling Up, Housing and Communities, 2024), sets out national planning policies that reflect priorities of the Government for operation of the planning system and the economic, social, and environmental aspects of the development and use of land. The NPPF has a strong emphasis on sustainable development, with a presumption in favour of such development. The NPPF has the potential to be considered important and relevant to the Secretary of State (SoS)' consideration of the Proposed Project.

2.2.13 Table 2.4 below provides details of the elements of the NPPF that are relevant to this chapter, and how and where they are covered in the ES.

Table 2.4 NPPF requirements relevant to benthic ecology

NPPF section	Where this is covered in the ES
Paragraph 187 "*Planning policies and decisions should contribute to and enhance the natural and local environment by [inter alia] … protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development*	Benthic ecology features of interest which will be impacted by project activities are considered in Section 2.7 and an

NPPF section	Where this is covered in the ES
plan); … [and] recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services; … [and] minimising impacts on and providing net gains for biodiversity; …[and] preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability".	assessment of impacts can be found in Section 2.9. Relevant designated sites have been further subjected to an HRA (**Application Document 6.6 Habitats Regulations Assessment Report**). Any requirements for BNG will be considered within (**Application Document 6.12 Environmental Gain Report**).
Paragraph 188 *"Plans should: distinguish between the hierarchy of international, national and locally designated sites; allocate land with the least environmental or amenity value, where consistent with other policies in this Framework; take a strategic approach to maintaining and enhancing networks of habitats and green infrastructure; and plan for the enhancement of natural capital at a catchment or landscape scale across local authority boundaries*".	Locally, nationally, and internationally designated sites have all been considered where relevant for benthic ecology receptors. Details for relevant designated sites is provided in Section 2.7 and undergo an HRA (**Application Document 6.6 Habitats Regulations Assessment Report**).
Paragraph 192 *"To protect and enhance biodiversity and geodiversity, plans should: Identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity; wildlife corridors and stepping stones that connect them; and areas identified by national and local partnerships for habitat management, enhancement, restoration or creation; [and] promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity."*	Impacts to biodiversity are considered in Section 2.9. and the HRA (**Application Document 6.6 Habitats Regulations Assessment Report**).
Paragraph 193 *"When determining planning applications, local planning authorities should apply the following principles: if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused; [and] development on land within or outside a Site of Special Scientific Interest, and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely*	Impacts to biodiversity are considered in Section 2.9. and the HRA (**Application Document 6.6 Habitats Regulations Assessment Report**). Consideration has been given to relevant designated sites and species in the project design. Details for relevant designated sites is provided in Section 2.7.

NPPF section	Where this is covered in the ES
impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of Sites of Special Scientific Interest; [and] development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to improve biodiversity in and around developments should be integrated as part of their design, especially where this can secure measurable net gains for biodiversity or enhance public access to nature where this is appropriate."	
Paragraph 194 *"The following should be given the same protection as habitats sites: possible Special Areas of Conservation; [and] listed or proposed Ramsar sites; [and] sites identified, or required, as compensatory measures for adverse effects on habitats sites, potential Special Protection Areas, possible Special Areas of Conservation, and listed or proposed Ramsar sites."*	No possible/proposed sites have been identified in addition to existing designations. A full list of sites designated for the protection of benthic ecological features is provided in Section 2.7 and the HRA (**Application Document 6.6 Habitats Regulations Assessment Report**).

National Planning Practice Guidance

2.2.14 This Chapter has also followed National Planning Practice Guidance for the Natural Environment (Department for Levelling Up, Housing and Communities, and Ministry of Housing, Communities and Local Government, 2016), which describes how biodiversity and ecosystems should be considered, for the purpose of conserving biodiversity. This follows guidance on evidence required, such as location of designated sites and the distribution and consideration of protected and priority species. In addition, guidance has been followed applying policy to avoid, mitigate or compensate for significant harm to biodiversity, to ensure that project impacts do not cause adverse effects to fish and shellfish.

Marine Planning Policy

2.2.15 The following marine plans are relevant to benthic ecology and have informed the assessment of preliminary effects in this chapter:

- The UK Marine Policy Statement (MPS), which was adopted in 2011 and provides the policy framework for the preparation of marine plans and establishes how decisions affecting the marine area should be made (HM Government, 2011);
- East Inshore and East Offshore Marine Plan (Defra, 2014); and
- South East Inshore Marine Plan (Defra, 2021).

Table 2.5 Marine Planning Policies relevant to benthic ecology

Marine Plan	Where this is covered in the ES
The UK MPS ensures that marine resources are used in a sustainable way by ensuring biodiversity is protected and conserved by using the precautionary principle and relying on sound evidence.	In line with policy objectives in the MPS, this Chapter has taken into consideration measures that can be taken to avoid biodiversity loss. Where possible, consideration has been given to conserving and avoiding harm to benthic ecology through routeing, mitigation, and consideration of reasonable alternatives. Potential adverse effects to designated sites and protected features have been avoided where possible. Details of protected sites and species designations are provided in Section 2.7, with an assessment of impacts and in Section 2.9. Relevant mitigation is detailed in Section 2.8.
East Inshore and East Offshore Marine Plan ensures biodiversity is protected and conserved between Flamborough Head and Felixstowe.	Routeing of the Offshore Scheme has been selected to avoid sensitive habitats (**Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**). An ecosystems-based approach has been adopted and cumulative impacts have been considered to ensure that effects from project activities do not adversely impact benthic ecology.
South East Inshore Marine Plan ensures biodiversity is protected and conserved between Felixstowe and Dover.	

Local Planning Policy

2.2.16 The intertidal area of the Offshore Scheme lies within the jurisdiction of Suffolk County Council and Kent County Council. County planning guidance which is relevant to a study of benthic ecology matters and has informed the assessment of preliminary effects in this chapter as are follows:

- Suffolk Coastal Local Plan (2020); and
- Draft Dover District Local Plan (Reg 19) (2022).

2.2.17 The Suffolk Landfall lies within the boundary of the Suffolk Coastal Local Plan (2020). Local Plan policies which are relevant to benthic ecology matters and where they have informed the benthic ecology assessment are detailed in Table 2.6.

Table 2.6 Local planning policies relevant to benthic ecology – Suffolk Coastal Local Plan

Suffolk Coastal Local Plan - Policy	Where this is covered in the ES
Policy SCLP10.1: Biodiversity and Geodiversity *This policy sets out a requirement for all development to achieve a net gain for biodiversity,*	Benthic ecology features of interest which will be impacted by project activities are considered in section 2.7.

Suffolk Coastal Local Plan - Policy	Where this is covered in the ES
identifies that development which would harm a local wildlife site will not be supported unless the benefits of the project outweigh the harm caused, identifies the need for surveys if protected or Suffolk priority species are present, identifies the need for Habitats Regulations Assessment where SACs and SPAs are involved, and sets out the mitigation hierarchy of avoid-mitigate-compensate.	Relevant designated sites have been further subjected to an HRA (**Application Document 6.6 Habitats Regulations Assessment Report**). Any requirements for BNG will be considered within **(Application Document 6.12 Environmental Gain Report)**.
Policy SCLP10.3: Environmental Quality *Policy requires development proposals to minimise all forms of pollution. Specific pathways relevant to ecological receptors are air quality, water quality and noise and light pollution.*	Impacts to marine water quality from the use of HDD have been considered in Section 2.9 with relevant mitigation measures identified at this stage are provided in Section 2.8. Further mitigation measures are identified in **Application Document 7.5.3.1 CEMP Appendix A Outline Code of Construction Practice.**

2.2.18 The Kent Landfall is located within the jurisdiction of Dover District Council. Local Plan policies which are relevant to benthic ecology matters and where they have informed the benthic ecology assessment are detailed in Table 2.7.

Table 2.7 Local planning policies relevant to benthic ecology – Draft Dover District Plan

Draft Dover District Local Plan - Policy	Where this is covered in the ES
Strategic Policy 13: Protecting the District's Hierarchy of Designated Environmental Sites and Biodiversity Assets This policy sets out that development which is likely to adversely affect the integrity of international or European designated sites will not be permitted unless there are imperative reasons of overriding public interest and that it is demonstrated that any necessary compensatory measures in the absence of alternative solutions can be secured.	Benthic ecology features of interest which will be impacted by project activities are considered in Section 2.7 and an assessment of impacts can be found in Section 2.9. Relevant designated sites have been further subjected to an HRA (**Application Document 6.6 Habitats Regulations Assessment Report**).
Strategic Policy 14: Enhancing Green Infrastructure and Biodiversity The policy sets out all development must avoid a net loss of biodiversity and are required to achieve a net gain in biodiversity above the ecological baseline. It also states that every development will be required to connect to and improve the wider ecological networks in which it is located, providing	Any requirements for BNG will be considered within **(Application Document 6.12 Environmental Gain Report)**.

Draft Dover District Local Plan - Policy	Where this is covered in the ES
on-site green infrastructure that connects to off-site networks.	

2.3 Scoping Opinion and Consultation

Scoping

2.3.1 A Scoping Report (National Grid, 2022) for the Proposed Project was issued to the Planning Inspectorate (PINS) on 24 October 2022 and a Scoping Opinion (PINS, 2022) was received from the SoS on 1 December 2022 (**Application Document 6.2.1.6 Part 1 Introduction Chapter 6 Scoping Opinion and EIA Consultation).** Table 2.8 sets out the comments raised in the Scoping Opinion and how these have been addressed in this ES. The Scoping Opinion takes account of responses from prescribed consultees as appropriate. **Application Document 6.2.1.6 Part 1 Introduction Chapter 6 Scoping Opinion and EIA Consultation** provides responses to the comments made by the prescribed consultees at scoping stage and how each comment has been considered.

Table 2.8 Comments raised in the Scoping Opinion

ID	Inspectorate's comments	Response
5.2.1	[*Changes to marine water quality during cable installation and cable lay from the use of HDD drilling fluids (construction)].* The Applicant proposes to scope this matter out on the basis that the control and management measure LVS05 of the outline CoCP would be implemented meaning only inert (non-toxic), biodegradable drilling fluid will be used and disposed of at a licenced disposal site. The Inspectorate agrees that this matter can be scoped out on the basis that the mitigation measures proposed within the outline CoCP should be sufficient to address the likely impacts and avoid a likely significant effect. The ES should include details of the mitigation and explain how its delivery is assured with reference to relevant documents.	Following statutory consultation, changes to marine water quality during cable installation and cable lay from the use of drilling fluids has been scoped back into the assessment in Section 2.9. Relevant mitigation measures identified at this stage are provided in Section 2.8.
5.2.2	[*Changes to marine water quality from accidental leaks and spills from vessels, including loss of fuel oils (construction, maintenance and decommissioning*)]. The Applicant proposes to scope this matter out on the basis that the control and management measures referred to within the outline CoCP create limited potential for accidental spills to occur and should an accidental spill or leak	Changes to marine water quality from accidental leaks and spills from vessels, including loss of fuel oils has been scoped out and has not been assessed further. Relevant project design and embedded mitigation measures, which include industry best

ID	Inspectorate's comments	Response
	occur, it would be small in extent and subject to immediate control measures, dilution and rapid dispersal within the marine environment. The Inspectorate agrees that this matter can be scoped out on the basis that the mitigation measures proposed within the outline CoCP should be sufficient to address the likely impacts and avoid a likely significant effect. The ES should include details of the mitigation and explain how its delivery is assured with reference to relevant documents.	practice, identified at this stage are provided in Section 2.8.
5.2.3	[*Introduction and spread of invasive non-native species (INNS) via vessel hull or ballast water (construction, maintenance and decommissioning*)]. The Applicant proposes to scope this matter out on the basis that the control and management measures referred to within the outline CoCP make the introduction of INNS through ship hulls and ballast water unlikely. The Inspectorate agrees that this matter can be scoped out on the basis that the mitigation measures proposed within the outline CoCP such as the Biosecurity Plan should be sufficient to address the likely impacts and avoid a likely significant effect. The ES should include details of the mitigation and explain how its delivery is assured with reference to relevant documents.	Introduction and spread of INNS via vessel hull or ballast water has been scoped out and has not been assessed further. Relevant mitigation measures identified at this stage are provided in Section 2.8. This includes the production of **Application Document 7.5.12 Outline Offshore Invasive Non-Native Species Management Plan** and **Application Document 7.7 Marine Biosecurity Plan**.
5.2.4	[*Underwater sound impacts on marine invertebrates (intertidal and subtidal ecology) (construction, maintenance and decommissioning)].* The Applicant proposes to scope this matter out on the basis that the type and duration of underwater sound that will be generated by the Proposed Project will not have any significant effects on benthic invertebrates or benthic communities. In the absence of confirmed construction, details the Inspectorate considers that this matter should be scoped in for further assessment.	Underwater sound impacts on marine invertebrates has been scoped in for further assessment in Section 2.9.
5.2.5	[*EMF emissions (operation)].* The Applicant proposes to scope this matter out on the basis that significant effects from EMF are unlikely to occur due to the depth of cable burial and the limited sensitivity of benthic species. In the absence of an estimation of EMFs arising from cables the Inspectorate considers that this	The effects from EMF emissions have been scoped in for further assessment in Section 2.9.

ID	Inspectorate's comments	Response
	matter should be scoped in for further assessment.	
5.2.6	[*Methodology for bringing cables onshore*]. It is not clear what method will be used to bring the cables onshore from the subtidal to intertidal area. The Applicants attention is drawn to the advice from the EA (see Appendix 2 of this Opinion) which advises that for all potential methods for bringing cables onshore, potential disturbances to benthic ecology are scoped in. The Inspectorate agrees that this level of detail will support the assessment, and the understanding of likely significant effects associated.	The cables will be installed between the marine and onshore environment using a trenchless solution at both landfall locations. At the Suffolk Landfall, the entry/exit point, where the cable will be pulled for subsequent submarine installation, will be entirely in the subtidal environment, thus avoiding the intertidal area and any disturbance to intertidal benthic ecology receptors has been scoped out. However, for completeness a brief description of the intertidal area has been provided in Section 2.7. At the Kent landfall, the trenchless solution will act to completely avoid saltmarsh habitat, with the entry/exit point located within the intertidal range. Therefore, the intertidal environment in Kent has been included in Section 2.7 and is scoped in for assessment in Section 2.9.
5.2.7	[*Subtidal benthic habitats*]. The Inspectorate notes that the Scoping Report does not refer to benthic habitats surveyed within or adjacent to Marine Conservation Zones (MCZs). The ES should clearly identify protected features within or adjacent to designated sites such as Goodwin Sands MCZ and Kentish Knock East MCZ.	Subtidal benthic habitats within or adjacent to designated sites, including Goodwin Sands MCZ and Kentish Knock East MCZ, have been identified within Section 2.7. The MCZ Assessment is provided in **Application Document 6.11 Marine Conservation Zone Assessment**.

Statutory Consultation

2.3.2 Statutory consultation for the Proposed Project took place between 24 October and 18 December 2023. A further targeted consultation exercise on the main changes to the Proposed Project introduced after the 2023 statutory consultation, was undertaken between 8 July and 11 August 2024. A summary of relevant feedback received during statutory consultation relating to benthic ecology is provided below. Further details on how consultation responses have informed the assessment can be found in **Application Document 5.1 Consultation Report**.

2.3.3 Statutory consultees with feedback relevant to benthic ecology included Natural England, and Kent and Essex Inshore Fisheries and Conservation Authority (IFCA).

2.3.4 Key comments rising from Natural England feedback were:

- Natural England recommended that impact of HDD on intertidal and subtidal receptors are scoped into the assessment. In response to this comment:
  - Trenchless solutions will be used at both landfalls, with ground investigations have confirming the use of HDD. The use of HDD will be used with the assessments as a worst-case scenario;
  - At the Suffolk Landfall, the entry/exit point, will be entirely in the subtidal environment, thus avoiding the intertidal area. There will be no direct impacts to intertidal benthic ecology receptors at this location and therefore they have not been considered further in the impact assessment. Impacts on subtidal ecology receptors are considered in Section 2.9.
  - At the Kent landfall, this technique will avoid the sensitive saltmarsh habitats in the upper intertidal area. However, due to the extent of the intertidal area at this location, trenchless techniques cannot extend so far to avoid all works in the intertidal zone. Thus, impacts during HDD exit and cable pull at the exit point will affect the intertidal zone and cable trenching will affect both intertidal and subtidal habitats. Therefore, the intertidal environment in Kent is described in Section 2.7, and impacts to relevant intertidal habitats including temporary and physical disturbance, temporary increased suspended sediment concentrations (SSC), and changes to marine water quality during cable installation and cable lay from the use of drilling fluids are scoped into the assessment (Section 2.9); and
  - The Landfall Feasibility Technical Report has been updated to reflect this update, see Appendix A in **Application Document 7.3 Design Development Report**.
- Natural England advised that the Nemo Link interconnector, Thanet Offshore developments and the Atlantic Crossing 1, Mercator, Pan European Crossing and Tangerine telecommunication cables are included within the cumulative effects assessment and assessed appropriately for benthic impacts. In response to this comment:
  - The developments noted remain scoped out of the assessment as these are developments that will be completed prior the Proposed Project construction activities and little to no operation and maintenance activities are expected. Further cumulative/in-combination effects with other plans and projects on benthic ecology is provided in **Application Document 6.2.4.11 Part 4 Marine Chapter 11 Inter-Project Cumulative Effects**.
- Natural England expressed concerns regarding Goodwin Sands MCZ, requesting further information regarding impacts and mitigation measures to reduce the level of risk to acceptable levels and avoiding hindering the conservation objectives of the site. In response to these concerns:
  - The Offshore Scheme has been re-routed to completely avoid the Goodwin Sands MCZ, running directly adjacent to the boundary for approximately 3.2 km (**Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of**

the Proposed Project and **Application Document 7.3 Design Development Report**) and will avoid direct impacts on the site, reducing the impacts to the known and potential receptors located within the area, including *Mytilus edulis* beds (**Application Document 6.11 Marine Conservation Zone Assessment**). This follows the mitigation hierarchy, avoiding impacts to the features and conservation objectives of Goodwin Sands MCZ.

  - Additionally, based on updates to Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project and additional survey data (**Application Document 6.3.4.2.B Appendix 4.2.B Geophysical Survey Interpretation (Additional Surveys)**), all data to support the baseline and confidently assess impact pathways is presented in Section 2.9, including consideration of all features of conservation interest such as *M. edulis* beds and *Sabellaria spinulosa* reef.

2.3.5 Key comments arising from Kent and Essex IFCA feedback were:

- Kent and Essex IFCA have concerns regarding the impact on shellfish beds and supporting habitats of Pegwell Bay (Thanet Coast & Sandwich Bay SACs, and Thanet Coast and Sandwich Bay SPA and Ramsar site). In response to these concerns:
  - The impact on the shellfish beds (specifically cockle and whelk fisheries) and supporting habitats of designations in Pegwell Bay have been considered further in **Application Document 6.2.4.8 Part 4 Marine Chapter 9 Commercial Fisheries**, **Application Document 6.2.4.3 Part 4 Marine Chapter 3 Fish and Shellfish**, ; and
  - Potential impacts to designated sites are assessed in **Application Document 6.6 Habitats Regulations Assessment Report**.
- Kent and Essex IFCA advised that greater consideration should be given to abrasive impacts of vessels that would be operating in the vicinity of Pegwell Bay on benthic habitats including cockle beds and saltmarsh habitats. In response to this comment:
  - Upon approach to Pegwell Bay, the Order Limits have been widened in order to accommodate temporary construction activities (anchors, jack-up legs, and vessels).
  - In Pegwell Bay, the use of trenchless techniques such as HDD will completely avoid the sensitive saltmarsh habitats in the upper intertidal area. The cable will be installed from the onshore scheme via HDD which will exit in the intertidal zone, approximately 150 m below the lower boundary of the saltmarsh (**Figure 6.4.4.2.4 Habitats Present at, and Location of, Trenchless Solution Entry/Exit Points** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). The cable will be pulled through and installed by trenching techniques (similar to activities further offshore) in the intertidal zone and into the subtidal. Thus, cable trenching will affect both intertidal and subtidal habitats. Therefore, the intertidal environment for Pegwell Bay has been described in Section 2.7, and impacts to relevant intertidal habitats including temporary and physical disturbance, temporary increased SSC, and changes to marine water quality during cable installation and cable lay from the use of drilling fluids are scoped into the assessment (Section 2.9).

- A summary of the maximum design scenario has been presented in Table 2.17, and an assessment of impacts associated with construction have been provided in Section 2.9.
- The impact on shellfish beds have been considered further in **Application Document 6.2.4.8 Part 4 Marine Chapter 8 Commercial Fisheries** and **Application Document 6.2.4.3 Part 4 Marine Chapter 3 Fish and Shellfish**.

Further Engagement

2.3.6 No further engagement specific to benthic ecology was conducted.

Summary of Scope of Assessment

2.3.7 Following engagement with stakeholders at statutory consultation, impacts that have been assessed further are:

- temporary physical disturbance to benthic habitats and species;
- direct loss of subtidal benthic habitats and species due to placement of hard substrates on the seabed;
- temporary increase in SSC and sediment deposition leading to increased turbidity and smothering effects and possible contaminant mobilisation;
- changes to marine water quality during cable installation and cable lay from the use of drilling fluids;
- introduction and spread of INNS via the addition of cable protection during construction and maintenance;
- underwater sound impacts on marine invertebrates;
- effects of electromagnetic field (EMF) emissions; and,
- disturbance to benthic habitats and species due to subsea cable thermal emissions.

2.3.8 Following PEIR and stakeholder consultation, impacts during all phases that have been scoped out from further assessment are:

- changes to marine water quality from accidental leaks and spills from vessels, including loss of fuel oils; and
- the potential impact of the introduction of INNS via vessel hull or ballast water.

2.4 Approach and Methodology

2.4.1 **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology** sets out the overarching approach which has been used in developing the environmental assessment. This section describes the technical methods used to determine the baseline conditions, sensitivity of the receptors and magnitude of effects and sets out the significance criteria that have been used for the benthic assessment.

Guidance Specific to the Benthic Ecology Assessment

2.4.2 The preliminary benthic ecology assessment has been carried out in accordance with the following good practice guidance documents:

- Chartered Institute for Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in Britain and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018);
- The Convention for the Protection of the Marine Environment of the North-East Atlantic, or OSPAR Convention (the Convention for the Protection of the Marine Environment of the North-East Atlantic), produced the OSPAR List of Threatened and/or Declining Species and Habitats, considered to be of conservation concern within the north-east Atlantic (OSPAR Commission, 2008);
- Assessment of the environmental impacts of cables (OSPAR Commission, 2023), which assesses the environmental impacts of sea cables in terms of their relevance for the area covered by the Convention;
- Natural England and JNCC 2022 guidance 'Nature conservation considerations and environmental best practice for subsea cables for English Inshore and UK offshore waters.' (Natural England; JNCC, 2022)
- Refining the criteria for defining areas with a 'low resemblance' to Annex I stony reef (Golding, Albrecht, & McBreen, 2020) which supports habitat classification;
- Defining and managing *S. spinulosa* reefs (Gubbay, 2007);
- The identification of the main characteristics of Annex I stony reef habitats under the Habitats Directive (Irving, 2009); and
- OSPAR case study report for blue mussel beds on mixed and sandy sediment (OSPAR, 2010).

2.4.3 In the absence of Environmental Quality Standards for in situ sediments in the UK, the following guidance has been used to inform a 'Weight of Evidence' approach to assess whether benthic ecology is at risk from concentrations of toxic contaminants:

- Centre for Environment, Fisheries and Aquaculture Science (CEFAS) Chemical Action Levels (MMO, 2014). These values are used in conjunction with a range of other assessment methods to make management decisions regarding the fate of dredged material. The action levels are not 'pass/fail' criteria but triggers for further assessment. In general, contaminant levels in dredged material below Action Level 1 are of no concern and are unlikely to influence the licensing decision. However, dredged material with contaminant levels above Action Level 2 is generally considered unsuitable for sea disposal. Dredged material with contaminant levels between Action Levels 1 and 2 requires further consideration and testing before a decision can be made. Action Levels are therefore used as a guide in assessments of sediment contamination in non-dredging activities;
- Canadian Sediment Quality Guidelines (CCME, 2001) applied to contaminants where no other regional threshold value is available. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life. The Canadian Sediment Quality Guidelines were developed by the Canadian Council of Ministers of the Environment (CCME) as broadly protective tools to support the functioning of healthy aquatic ecosystems;
- UK Offshore Operators Association (UKOOA) sediment quality guidelines for the UK North Sea (UKOOA, 2001); and

OSPAR background concentrations and background assessment concentrations and effect range low (ERL) and effect range median (ERM) concentrations for contaminants (OSPAR Commission, 2009b).

Baseline Data Gathering and Forecasting Methods

2.4.4 The benthic ecology baseline conditions have been established by undertaking a combination of desktop review of published information, collection of project-specific survey data, and consultation with relevant organisations. The baseline provides a robust and up-to-date characterisation of the benthic environment within the Study Area.

Desk study

2.4.5 A significant amount of publicly available data exists for benthic ecology in the Study Area. A large proportion of this information has been produced for current and historical offshore developments, such as offshore wind farms and subsea cable projects, which have required statutory or non-statutory Environmental Impact Assessments (EIA).

2.4.6 Where relevant, this information has been used to help inform the benthic ecology baseline characterisation for the Offshore Scheme. In addition, a range of other data sources have been used to inform the baseline description and appraisal including:

- Kent Habitat Survey Partnership (2003) for Phase 1 habitat survey data in Kent;
- European Marine Observation Data Network (EMODnet) Seabed Habitats Project data for broad-scale habitat maps of the Study Area (EMODnet, 2021);
- European Union Nature Identification System (EUNIS) for classifying benthic habitats (EEA, 2021);
- Defra Future Coast Project (2022) for coastal evolution predictions;
- Marine Data Exchange Offshore Wind Environmental Evidence Register (OWEER) (2021);
- Marine Life Information Network for habitat and species sensitivity assessments, where available (MarLIN, 2023);
- CEFAS OneBenthic Portal (2022);
- MAGIC maps for designated and protected sites (Defra, 2024);
- Designated sites condition assessments as available;
- Academic papers and online reports as available for the Study Area; and
- Relevant Environmental Statements.

Intertidal Characterisation Survey 2023

2.4.7 An intertidal survey at the Kent landfall, was conducted on the 13 and 14 June 2023, followed by an intertidal survey at the Suffolk landfall on the 11 and 12 September 2023 (**Application Document 6.3.4.2.C Appendix 4.2.C Intertidal Survey Report**).

2.4.8 Phase I surveys were conducted across the entire area of each of the potential landfall corridors to determine biotope composition and distribution. This included recording any features of conservation importance, including Annex I habitats, and notable species. The surveys were conducted in accordance with best practice guidance, including the

JNCC Marine Monitoring Handbook Procedural Guidelines (Davies, et al., 2001), Wyn et al. (2000), JNCC (2010), and Nobel-James et al. (2018).

2.4.9 At each location, three transects were placed at intervals along the shore. Along each transect, three sediment core samples (0.01 m^2) were collected at different shore heights (upper, mid, and low shore). The sediment core samples were collected for macrofaunal analysis and particle size analysis (PSA). Quadrat sampling was required at upper and mid shore sampling points in Suffolk due to pebbles and cobbles preventing sampling with core samplers. At these stations, a 0.25 m^2 quadrat was used.

2.4.10 Following the surveys, intertidal biotopes were characterised following the Marine Habitat Classification system for Ireland and Britain (Connor, et al., 2004), with reference to Parry (2015) and updated to the EUNIS classification system (EEA, 2021).

Subtidal Characterisation Survey 2021

2.4.11 A dedicated subtidal benthic survey was carried out between 08 September and 06 October 2021 to characterise benthic ecological conditions and map the distribution and extent of habitats along the subtidal Offshore Scheme. Detailed information related to the benthic surveys undertaken and the findings are provided in **Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)**, with a summary of the methods provided below and a baseline within Section 2.7. Since completion of this survey, the Offshore Scheme Boundary has been refined and specific sampling stations and transects are now located beyond the Offshore Scheme Boundary. Relevant sampling stations have been presented in Table 2.9.

2.4.12 The two key objectives of the subtidal surveys were to:

- Collect video/stills footage and grab samples from pre-defined stations positioned along the Offshore Scheme, in order to characterise seabed sediments and associated benthic communities within this area.
- Collect additional video/stills at proposed ground truthing stations along the Proposed Project route, particularly where features of interest were observed (e.g., mottled seabed indicative of possible reef habitats etc.) to allow for high confidence mapping of any habitats of conservation importance.

2.4.13 Sample stations were selected by reviewing remote sensing data provided by side scan sonar (SSS) and multi beam echo sounder (MBES) from a preliminary geophysical survey. The number and location of sample stations were determined based on depth variation, sediment, and habitat changes to provide benthic data for all habitat types interpreted across the survey route. As a result, the sampling effort was concentrated in areas of heterogeneous seabed. This resulted in the selection of 37 subtidal sampling stations, 21 of which are within the current Offshore Scheme Boundary (Table 2.9; **Figure 6.4.4.2.5 Subtidal Marine Survey Locations** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**), positioned to reflect the diversity of habitats identified in the geophysical survey data.

2.4.14 Grab sampling was carried out at each of the survey stations for quantitative macrofaunal, PSA, and sediment chemical analysis. The primary grab sampler utilised was a dual Van veen (2 x 0.1 m^2) and the secondary a Hamon grab (0.1 m^2).

2.4.15 In areas with hard bottom substrates or sensitive areas that could not be sampled with grab samplers, grab sampling was not attempted, and an extended drop-down video (DDV) transect was performed to identify epifauna and habitat transitions. The survey line was planned over the area of interest, and still images were collected along the entire DDV transect. Five DDV transects were performed in total, three of which are within the Offshore Scheme Boundary (Table 2.9).

2.4.16 To connect the epifaunal to the faunal assemblage, and to minimise impacts to sensitive seabed habitats and features, five minutes of continuous video were acquired by the DDV system and a minimum of five still images collected along each video transect preceding any grab sampling. Where sensitive habitats were observed, grab samples were not taken.

2.4.17 Grab samples, DDV, PSA and macrofaunal data obtained from the surveys were used to classify the sampled areas in accordance with the EUNIS classification system (EEA, 2021). Habitats were subsequently assessed in terms of their ecological and conservation importance, drawing from current marine legislation and guidance.

Table 2.9 Sampling stations from the Subtidal Characterisation Survey 2021 and location to the Offshore Scheme Boundary

Subtidal sampling station/transect*	Nearest kilometre point (KP)	Within Offshore Scheme Boundary?	Subtidal sampling station/transect*	Nearest kilometre point (KP)	Within Offshore Scheme Boundary?
S004	4.1	Yes	S023	105.8	Yes
S005	5.3	Yes	S024	106.3	No
S006	8.7	Yes	S025	107.2	No
S007	10.3	Yes	S026	108.0	No
S008	11.6	Yes	S027	108.3	No
S009	14.2	Yes	S028	108.8	No
S010	17.6	Yes	S029	109.5	No
S011	21.2	No	S030	110.0	No
S012	25.0	No	S031	110.4	No
S013	29.2	No	S032	2.5	Yes
S014	31.5	Yes	S033	1.9	Yes
S015	47.4	Yes	S036	112.0	Yes
S016	50.1	Yes	S037	114.7	Yes
S017	62.2	Yes	T001	10.2	Yes
S018	70.2	Yes	T002	10.2	Yes
S019	75.5	Yes	T003	108.7	No
S020	87.9	Yes	T004	108.7	No

Subtidal sampling station/transect*	Nearest kilometre point (KP)	Within Offshore Scheme Boundary?	Subtidal sampling station/transect*	Nearest kilometre point (KP)	Within Offshore Scheme Boundary?
S021	102.5	Yes	T005	10.2	Yes
S022	105.3	Yes			

**S001, S002, S003, S034, and S035 are sample stations located within previous routing of the Proposed Project so do not have a corresponding KP*

Geophysical Survey 2024

2.4.18 Following consultation and a minor route change, where the Offshore Scheme Boundary deviates from the Benthic Characterisation Report 2021 survey area (**Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)**), a geophysical survey (**Application Document 6.3.4.2.B Appendix 4.2.B Geophysical Survey Interpretation (Additional Surveys)**) was commissioned to understand seabed morphology, shallow sediment structure, and to provide benthic characterisation at these locations. This survey was undertaken in 2024, and covered following sections of the Offshore Scheme Boundary (**Figure 6.4.4.2.5 Subtidal Marine Survey Locations** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**):

- KP1.0 - KP3.2, nearshore of the Suffolk Landfall;
- KP17.7 - KP32.3;
- KP33.8 - KP42.0;
- KP99.0 - KP103.2, north of Goodwin Sands MCZ; and
- KP104.7 - KP114.5, west of Goodwin Sands MCZ.

2.4.19 The initial interpretations of the seabed sediments and potential sensitive habitats are based on SSS and MBES data.

Additional Subtidal Survey 2024

2.4.20 Following consultation and a minor route change, where the Offshore Scheme Boundary deviates from the Benthic Characterisation Report 2021 survey area (**Application Document 6.3.4.2.A Part 4 Marine Chapter 3 Benthic Characterisation Report**), an additional subtidal survey was commissioned in 2024 to assess areas of the Offshore Scheme that were not included in the original survey (**Application Document 6.3.4.2.D Appendix 4.2.D Interim Subtidal Survey Report (Additional Surveys)**). This ensured a complete understanding of the ecological conditions across the entire Offshore Scheme.

2.4.21 Prior to sampling operations, SSS and MBES data were collected in areas where the Offshore Scheme Boundary deviates from the Subtidal Characterisation Survey 2021 survey area. This data informed the location of 17 survey stations, ensuring comprehensive coverage of the targeted areas (**Figure 6.4.4.2.5 Subtidal Marine Survey Locations** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). At each of the survey stations, a drop-down camera system was deployed over a transect of 50 – 150 m to capture high-quality imagery was deployed across the survey area (Table 2.10). At eight of the survey stations, a grab sample was collected (Table 2.10), using a dual Van veen (2 x 0.1 m^2) or a Hamon grab (0.1 m^2), for quantitative macrofaunal, PSA, and sediment chemical analysis.

2.4.22 The seabed imagery, grab samples and macrofaunal data obtained from the surveys were used to describe sediments at the targeted areas, as well as highlighting the potential protected habitats and species.

2.4.23 Grab samples, DDV, PSA and macrofaunal data obtained from the surveys were used to classify the sampled areas in accordance with the EUNIS classification system (EEA, 2021). Habitats were subsequently assessed in terms of their ecological and conservation importance, drawing from current marine legislation and guidance.

Table 2.10 Survey stations from the Additional Subtidal Survey 2024

Survey station	Nearest kilometre point	Survey station	Nearest kilometre point
A2_ES_01*	21.3	A3_NS_03_HAS	40.5
A2_ES_02*	24.2	A4_GLC_01*	101.7
A2_ES_03*	27.6	A4_GLC_02	99.7
A2_ES_04*	31.4	A4_GLC_03*	103.2
A2_ES_05_HAS	29.2	A5_OBP_01*	108.5
A2_ES_ADD_01	29.1	A5_OPB_04_HAS	107.4
A2_ES_ADD_02	29.3	A5_OPB_05_HAS	109.4
A3_NS_01*	37.2	A5_OPB_ADD_01	109.2
A3_NS_02_HAS	40.5		

**Survey stations that also included a grab sample*

Assessment Criteria

2.4.24 Several factors have been considered when assessing the impacts on benthic ecology resulting from the Offshore Scheme including sensitivity of the receptors and the magnitude of the impact Together these have been used to assess the overall significance of effects. The magnitude of impacts considers both the scale and duration of the impact. Consideration is also given to whether the damage caused by the impact is reversible or not.

2.4.25 This chapter applies the appraisal methodology as detailed in **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology**. In combination with CIEEM guidelines for ecological assessment in the UK (2018), professional judgement, and the application of relevant guidance as discussed in the above sections.

Sensitivity of benthic receptors

2.4.26 When defining sensitivity, reference has been made to the criteria levels set out in **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology**: very high, high, medium, low and negligible. To determine sensitivity of the receptor, the vulnerability of the receptor to the specific impact and its ability to recover and adapt were also considered. Vulnerability differs between different benthic ecology receptors and the ability to recover also differs between species and habitats, with some more likely to recover over a shorter timeframe. For example, mobile sands are naturally subject to elevated levels of physical disturbance from water movement (from waves and/or tides), often have low diversity communities, and so are tolerant of mechanical disturbance, recovering rapidly after the activity stops.

2.4.27 The importance, or value, of the receptor on an international, national, and local scale has also been considered in assessing sensitivity.

Magnitude of benthic effects

2.4.28 The magnitude of an impact that could affect benthic ecology is influenced by several key factors, including the scale of the change (and how much the receptor is likely to be affected which could range from individuals and species to whole communities), the spatial extent over which the impact is likely to occur, and the duration and frequency of the impact.

2.4.29 Habitats vary and can range from being highly dynamic low diversity to stable communities supporting a wide range of infauna and epifauna. Many benthic species are slow-moving or sessile organisms, and thus avoidance of the impact may not be possible, so the effect from a single activity will vary. When defining the magnitude of the impact, criteria detailed in **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology** has been followed: large, medium, small, and negligible.

Significance benthic effects

2.4.30 As set out in **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology** the general approach taken to determining the significance of effect in this preliminary assessment is only to state whether effects are likely or unlikely to be significant, rather than assigning significance levels.

2.4.31 When determining whether an effect is significant, the magnitude of impact and sensitivity of the receptor is accounted for. Professional judgement has also been applied to allow for consideration of previous project knowledge and ecological context. Additionally, a precautionary approach has been taken with the worst-case scenario assessed for each impact, in order to account for any uncertainty or lack of baseline survey data in the assessment.

2.4.32 The criteria for assessing effects and residual significance are presented in **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology.**

Assumptions and Limitations

2.4.33 In terms of the field survey, although the sampling design and collection process for the survey data analysed provided robust data on the benthic communities, interpreting these data by classifying and grading biotopes has three main limitations:

- it can be difficult to interpolate data collected from discrete sample locations to cover the whole Study Area and to define the precise extent of each biotope, even with site specific geophysical data;
- benthic communities generally show a transition from one biotope to another and therefore, boundaries of where one biotope ends and the next begins cannot be defined with absolute precision; and
- the classification of the community data into biotopes is not always straightforward, as some communities do not readily fit the available descriptions in the biotope classification system and the classification for subtidal benthic communities is generally regarded as incomplete.

2.4.34 Despite these limitations, every effort has been made to obtain data concerning the existing environment and to accurately predict the likely environmental effects of the Proposed Project. It is considered that the baseline information collected and used for this appraisal is representative of the Study Area.

2.5 Basis of Assessment

2.5.1 This section sets out the assumptions that have been made in respect of design flexibility maintained within the Proposed Project and the consideration that has been given to alternative scenarios and the sensitivity of the assessment to changes in the construction commencement year.

2.5.2 Details of the available flexibility and assessment scenarios are presented in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project** and **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology**.

Flexibility Assumptions

2.5.3 The environmental assessments have been undertaken based on the description of the Proposed Project provided in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**. To take account of the flexibility allowed in the Proposed Project, consideration has been given to the potential for effects to be of greater or different significance should any of the permanent or temporary infrastructure elements be moved within the Limits of Deviation (LoD) or Order Limits.

2.5.4 The assumptions made regarding the use of flexibility for the main assessment, and any alternatives assumptions are set out in Table 2.11 below.

Table 2.11 Flexibility assumptions

Element of flexibility	How it has been considered within the assessment?
Lateral LoD marine HVDC cable	The worst-case scenario assessed for the Offshore Scheme is one bundled HVDC (x2) and one fibre optic cable in one trench. This bundled scenario maybe placed anywhere within the Offshore Scheme Boundary.

Sensitivity Test

2.5.5 It is likely that under the terms of the draft DCO, construction could commence in any year up to five years from the granting of the DCO which is assumed to be 2026. Consideration has been given to whether the effects reported would be any different if the works were to commence in any year up to year five. Where there is a difference, this is reported in Section 2.9.

2.6 Study Area

2.6.1 The Offshore Scheme Boundary runs from mean high-water springs (MHWS) at the landfall in Aldeburgh, Suffolk, to MHWS at the landfall in Pegwell Bay, Kent, crossing the outer Thames Estuary in the southern North Sea (**Figure 6.4.4.2.1 Benthic Ecology Study Area and Relevant Designated Sites** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). The Offshore Scheme is situated entirely within UK territorial waters and is up to 122 km in length (**Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**). The Offshore Scheme Boundary is 500 m wide for the majority of the Offshore Scheme representing a typical offshore working corridor within which the cable can be laid.

2.6.2 The Study Area, a 17 km wide area around the Offshore Scheme centre line, has been selected to encompasses all potential impact pathways for benthic receptors (**Figure 6.4.4.2.1 Benthic Ecology Study Area and Relevant Designated Sites** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**) as identified in Section 2.7. This is based on an understanding of the extent of likely impacts of the Offshore Scheme, providing a precautionary geographic context, and encompassing the relevant functional habitats and potential maximum dispersion of suspended particles in one tidal cycle. This zone of influence (ZOI) has also been used to screen for designated sites for benthic ecology receptors.

2.6.3 The Offshore Scheme will use a trenchless solution, such as HDD, at both landfall locations. At the Suffolk landfall, the entry/exit point, where the cable will be pulled for subsequent submarine installation, will be entirely in the subtidal environment, thus avoiding the intertidal area. There will be no direct impacts to intertidal benthic ecology receptors at this location and therefore it has not been considered further in the impact assessment. In Kent, the trenchless solution will completely avoid saltmarsh habitat, exiting approximately 105 - 140 m down shore of this habitat, exiting within intertidal mudflats. Therefore, the intertidal environment at Kent will be considered within the assessment, and thus is incorporated into the Study Area.

2.7 Baseline Conditions

2.7.1 Benthic ecology refers to the diversity, abundance, and function of organisms living on (epifauna) or in (infauna) the seabed. Benthic communities are found in all marine habitats, from the deepest parts of the ocean to the intertidal zone. Physical factors such as water depth, seabed and/or sediment type, and supply of organic matter, determine habitat types and species present, and therefore the composition of benthic communities. The Study Area includes a range of benthic habitats including intertidal habitats, and infralittoral (shallow waters closest to the shore, often dominated by vegetated habitats) and circalittoral (usually dominated by fauna) subtidal habitats.

2.7.2 Intertidal surveys were commissioned to characterise the intertidal habitats at both the Suffolk and Kent Landfalls (see survey report presented in **Application Document 6.3.4.2.C Appendix 4.2.C Intertidal Survey Report**). Moreover, a dedicated subtidal survey was commissioned to characterise benthic ecological conditions and map the distribution and extent of marine benthic habitats within the Offshore Scheme (see survey report presented in **Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report))**. Following consultation and a minor route change, where the Offshore Scheme Boundary deviates from the Benthic Characterisation Report 2021 survey area (**Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)**), a geophysical survey (**Application Document 6.3.4.2.B Appendix 4.2.B Geophysical Survey Interpretation (Additional Surveys)**) and an additional subtidal survey (**Application Document 6.3.4.2.D Appendix 4.2.D Interim Subtidal Survey Report (Additional Surveys)**)was commissioned in 2024 to assess areas of the Offshore Scheme that were not included in the original survey.

2.7.3 The following sections provide an overview of the survey data as well as the published information that has been used to characterise baseline conditions for benthic ecology within the Study Area (Section 2.6).

Intertidal Ecology

Suffolk Landfall

2.7.4 The Suffolk landfall is located on the coast, between Aldeburgh and Thorpeness (**Figure 6.4.4.2.4 Habitats Present at, and Location of, Trenchless Solution Entry/Exit Points** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). As previously discussed, trenchless techniques will be used under the transition zone between the onshore and offshore elements, with the entry/exit point located entirely in the subtidal environment. As there will be no direct impacts to intertidal benthic ecology receptors at this location, it has not been considered further in the impact assessment. However, for completeness, a summary of the intertidal environment at the Suffolk landfall is presented below.

2.7.5 An intertidal survey of the intertidal zone at landfall was completed in Summer 2023 (**Application Document 6.3.4.2.C Appendix 4.2.C Intertidal Survey Report**) which did not observe any species listed under Annex II of the Habitats Directive (2017a) or species of national conservation importance under Section 41 of the NERC Act (2006). Nor were there any non-native species identified (**Application Document 6.3.4.2.C Appendix 4.2.C Intertidal Survey Report**). The survey found that the upper and mid shore was covered in barren shingle, with the lower shore dominated by coarse sand mixed with pebbles. Denser vegetation higher up the shingle bank was indicative of ‘coastal vegetated shingle’, a habitat of ‘principal importance’ under Section 41 of the NERC Act (2006). This habitat is specifically protected by the Leiston-Aldeburgh Site of Special Scientific Interest (SSSI), however, as this habitat is located above MHWS and trenchless techniques will be used, there will be no direct impacts to this shingle habitat, and it is not considered further in the assessment.

Kent Landfall

2.7.6 The Kent landfall is located at Pegwell Bay. As with the Suffolk landfall, a trenchless solution, such as HDD, will be employed at the landfall. The entry/exit point will be located within the intertidal zone. Therefore, the baseline intertidal environment at Pegwell Bay will be outlined below and will be considered further within the assessment.

2.7.7 The Kent landfall is located within the Sandwich Bay to Hacklinge Marshes SSSI. This site is designated for the protection of a range of habitats, such as dunes and coastal grasslands above the marine environment, and saltmarsh and mudflats in the intertidal marine environment. The Thanet Coast SSSI, located to the north of the landfall site, is designated for the protection of foreshore habitats, such as sand and mudflats and areas of saltmarsh and coastal lagoons. Saltmarsh identified in the intertidal zone at Pegwell Bay, by the Kent Habitat Survey Partnership (2003), is representative of 'coastal saltmarsh', a habitat of 'principal importance' (HOPI) under Section 41 of the NERC Act (2006).

2.7.8 However, the use of a trenchless technique for the installation of the cable in the transition between the onshore and offshore schemes will avoid the saltmarsh habitat entirely, with the entry/exit points located 105 m to 140 m seaward from the edge of the saltmarsh. There will also be no vessels or vehicles interacting with the saltmarsh. Therefore, impacts on coastal saltmarsh have been scoped out of the assessment and are not considered further.

2.7.9 The habitats below the saltmarsh are mudflats which is also a habitat of 'principal importance' under Section 41 of the NERC Act (2006) and so considered in the impact assessment.

2.7.10 An intertidal survey of in Kent was completed in Summer 2023 (**Application Document 6.3.4.2.C Appendix 4.2.C Intertidal Survey Report**) identified a variety of habitats classified using the European Nature Information System (EUNIS) (EEA, 2021). This survey observed a muddy upper shore with areas with many that are indicative of the biotope '*Hediste diversicolor* and *Macoma balthica* in littoral sandy mud' (A2.312). Other upper shore sand was more rippled, with scattered lugworm (*Arenicola marina*) casts and many burrowing amphipods, which were assigned to the biotope '*Bathyporeia pilosa* and *Corophium arenarium* in littoral muddy sand' (A2.244). On the mid shore, the sand was less rippled and included more polychaete worms and cockles denoting the biotope '*Cerastoderma edule* and polychaetes in littoral muddy sand' (A2.242). The biotope '*Lanice conchilega* in littoral sand' (A2.425) was observed throughout the lower shore, with beds of the sand mason worms noted.

2.7.11 The survey also detailed that no species listed under Annex II of the Habitats Directive (2017a) or species of national conservation importance under Section 41 of the NERC Act (2006) were recorded, nor were there any non-native species identified (**Application Document 6.3.4.2.C Appendix 4.2.C Intertidal Survey Report**).

Subtidal Ecology

2.7.12 The subtidal benthic habitats identified along the Offshore Scheme are generally dominated by coarse sediments and sand. A variety of other habitats, classified using the EUNIS (EEA, 2021), are present throughout the length of the Offshore Scheme. The habitats and biotope complexes identified during the Subtidal Characterisation Survey 2021 are presented in **Figure 6.4.4.2.2 Subtidal Habitat Complexes and Annex I Habitats Identified Within the Offshore Scheme Boundary** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology** and Table 2.12. During this survey, a total of 26 EUNIS biotopes, across six habitat complexes, were identified (see Table 2.12).

Subtidal habitats and communities

2.7.13 The baseline has used data from the Subtidal Characterisation Survey 2021 (**Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)**), supplemented by existing habitat mapping data (EMODnet, 2021), the Geophysical Survey 2024 (**Application Document 6.3.4.2.B Appendix 4.2.B Geophysical Survey Interpretation (Additional Surveys)**), and the Additional Subtidal Survey 2024 (**Application Document 6.3.4.2.D Appendix 4.2.D Interim Subtidal Survey Report (Additional Surveys)**).

2.7.14 The subtidal benthic habitats identified along the Offshore Scheme were dominated by areas of coarse sediment and sand (**Figure 6.4.4.2.2 Subtidal Habitat Complexes and Annex I Habitats Identified within the Offshore Scheme Boundary** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). In nearshore areas there is presence of circalittoral rock (**Figure 6.4.4.2.4 Habitats Present at, and Location of, Trenchless Solution Entry/Exit Points** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**).

2.7.15 The shallow areas, in the northernmost sections of the landfall route (at a depth of approximately <5 m), were characterised by areas of fine sediment with patches of soft circalittoral rock such clay covered by a thin veneer of sand and/or gravel (**Figure 6.4.4.2.4 Habitats Present at, and Location of, Trenchless Solution Entry/Exit Points** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). Between KP1.0 and KP3.2, this presence of soft circalittoral rock was also noted during the most recent Geophysical Survey. The sediment habitat continues to approximately KP6.0, becoming increasingly mobile with rippled sands and sparse fauna, alternating between sediment habitats of sand and mud.

2.7.16 Further south, at around KP6.0, the seabed transitions into an area of mixed sediments supporting species including *S. spinulosa* (e.g., S006). However, an assessment of the extent, density and structure of the aggregations indicated no *S. spinulosa* reef formations were present. This habitat continues until KP9.6.

2.7.17 The mixed sediment habitats cover the majority of the route to KP17.7. However, from KP9.6, this is interspersed with small patches of soft circalittoral rock, areas of coarse sediments, and the minor presence of *S. spinulosa* (KP12.7 to KP15.4, e.g. S009) and blue mussel (*Mytilus edulis*) beds (KP9.6 to KP10.8, e.g. S007). A mixture of grab and video survey data indicates there is no presence of reef formations of either species (Gubbay, 2007; OSPAR, 2010) indicating the presence of patches rather than areas of continuous reef or mussel bed.

2.7.18 From KP17.8, the Offshore Scheme becomes dominated by sandy sediments, with the Geophysical Survey noting featureless areas of rippled fine sediments and localised patches of chalk with smaller patches of *S. spinulosa* aggregations, with the additional benthic survey noting fine sand habitat with occasional presence of cobbles until approximately KP31.4. At this point, the habitat transitions to a mixture of coarse and mixed sediment until approximately KP48.6, where the seabed becomes more heterogenous, and includes areas of trawl marks, ripples with coarser sediments and small areas of circalittoral rock. From KP55.9 to KP60.0, the seabed is dominated by softer sediments, thereafter coarser sediments and small areas of circalittoral rock dominate. These coarser sediments prevail southwards with occasional patches of finer sediments, including several large areas indicative of Annex I habitat subtidal sandbanks (H1110) (KP61.7 to KP69.7, KP76.7 to KP80.3, and KP96.3 to KP107.8).

2.7.19 Between KP99.0 and KP103.2, the Offshore Scheme comprised sand and gravel sediments. From KP104.7 geophysical survey data indicated the presence of sand, with evidence of coarse sediments then extending from KP109.6 with isolated patches of circalittoral rock.

2.7.20 During the Subtidal Characterisation 2021, six sample stations (S026 to S031) and two transects (T003 and T004) were located within Goodwin Sands MCZ. These stations indicated the presence of mixed sediments and sand biotopes, with three identifying the presence of juvenile blue mussels (S026, S027, and S029). Since this survey was undertaken, the Offshore Scheme has been re-routed to completely avoid the Goodwin Sands MCZ, so that the boundary runs directly adjacent to that of the MCZ, for 3.2 km from approximately KP107.3 to KP110.5.

2.7.21 At KP109.0, *M. edulis* beds were observed, and based on the OSPAR (2010) definition, were noted in densities indicative of Annex I 'biogenic reefs' habitat (H1170) (**Application Document 6.3.4.2.D Appendix 4.2.D Interim Subtidal Survey Report (Additional Surveys)**). Moreover, areas indicative of Annex I subtidal sandbank habitat (H1110) were identified between KP113.8 and KP117.6. However, neither of these Annex I habitats were identified within a designated site. As the route approaches the Kent Landfall, the sediment becomes more mixed, including small areas of soft circalittoral rock (at a water depth of approximately 2 m) in the southernmost areas around KP118.0.

Table 2.12 Summary of EUNIS subtidal broadscale habitats, habitat complexes and biotope complexes identified during the Subtidal Characterisation Survey 2021 of the Offshore Scheme

Broadscale habitat	Habitat complex	Biotope complex	E.g. Sample station/Transect
A4 Circalittoral rock and other hard substrata	**A4.2** Atlantic and Mediterranean moderate energy circalittoral rock	**A4.23** Communities on soft circalittoral rock	T001
		A4.23/A5.44 Communities on soft circalittoral rock/Circalittoral mixed sediments	Identified by geophysical data
A5 Sublittoral sediment	**A5.1** Sublittoral coarse sediments	**A5.13** Infralittoral coarse sediment	Identified by geophysical data
		A5.14 Circalittoral coarse sediment	Identified by geophysical data
		A5.14/ A5.44 Circalittoral coarse sediment/Circalittoral mixed sediment	S019 S021
		A5.141 *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Identified by geophysical data

Broadscale habitat	Habitat complex	Biotope complex	E.g. Sample station/Transect
		A5.141/ A5.14 *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles/ Circalittoral coarse sediment	S036
		A5.141/ A5.44 *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles/ Circalittoral mixed sediment	Identified by geophysical data
		A5.142 *Mediomastus fragilis*, *Lumbrineris* spp. And venerid bivalves in circalittoral coarse sand or gravel	S015
	A5.2 Sublittoral sand	**A5.23** Infralittoral fine sand	
		A5.231 Infralittoral mobile clean sand with sparse fauna	Identified by geophysical data
		A5.233 *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand	S022 S023
		A5.24 Infralittoral muddy sand	Identified by geophysical data
		A5.25 Circalittoral fine sand	S016
		A5.26 Circalittoral muddy sand	S004 S014 S020
		A5.261 *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment	S005
		A5.261/ A5.335 *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment/*Ampelisca* spp., *Photis longicaudata* and other tube-building amphipods and polychaetes in infralittoral sandy mud	S018
	A5.3 Sublittoral mud	**A5.33** Infralittoral sandy mud	Identified by geophysical data
		A5.35 Circalittoral sandy mud	Identified by geophysical data
		A5.355 *Lagis koreni* and *Phaxas pellucidus* in circalittoral sandy mud	S032 S033
		A5.355/A5.44 *Ampelisca* spp., *Photis longicaudata* and other tube-building amphipods and polychaetes in infralittoral sandy mud/Circalittoral mixed sediment	Identified by geophysical data
		A5.36 Circalittoral fine mud	Identified by geophysical data

Broadscale habitat	Habitat complex	Biotope complex	E.g. Sample station/Transect
	A5.4 Sublittoral mixed sediments	**A5.43** Infralittoral mixed sediments	S037
		A5.44 Circalittoral mixed sediment	S008 S010 S017 T002
	A5.6 Sublittoral biogenic reefs	**A5.611** *Sabellaria spinulosa* on stable circalittoral mixed sediment	S006 S009
		A5.625 *Mytilus edulis* beds on sublittoral sediment	S007 T001

Subtidal macrofauna

2.7.22 The subtidal survey area is generally comprised of rich and diverse macrofaunal communities, made up of infaunal and epifaunal invertebrates. A detailed assessment of the benthic macrofauna within the Offshore Scheme is presented in **Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)** and is summarised below.

2.7.23 Across the survey area polychaetes were the most abundant fauna, accounting for over half of all individuals collected from grab samples. They also accounted for just over 40% of taxa. Molluscs and crustaceans were also important components of benthic communities with molluscs accounting for 24% of individuals and 18% of taxa and crustaceans 15% of individuals and 30.5% of taxa. The molluscs were dominated by bivalves, such as *Limecola balthica*, *Abra alba*, and *M. edulis*. These three taxonomic groups accounted for 91% of the individuals and 89% of the recorded taxa from the grab samples.

2.7.24 In terms of colonial epifauna, a total of 273 separate colonies were identified, consisting of 43 different taxa. Of these, the dominant phyla were bryozoans, with 53% of the total taxa, followed by cnidarians accounting for a third of all epifaunal taxa. Abundance was also dominated by bryozoans with a total of 179 colonies, followed by cnidarians with a total of 85.

2.7.25 The abundance of polychaete worms peak in areas where the '*Sabellaria spinulosa* on stable circalittoral mixed sediment' biotope occurred (e.g. S009). Mollusc abundance was also at its highest when associated with biogenic reef (e.g. S007).

2.7.26 Species richness and the Shannon-Wiener diversity index varied across the grab samples. Several communities were identified through multivariate analysis, with results showing that gravel and mud together constituted the variables that best explained the observed pattern of spatial distribution for fauna. However, the sediment composition within the Offshore Scheme does not fully explain the associated fauna found. This is likely explained by other factors, such as water depth and hydrodynamics, as well as stochastic events like larval settlement, which also play a role in forming the faunal composition. However, it can also be an indication that the boundaries between sediment classes are not perfectly aligned with how they affect the species composition. Both explanations are likely affecting the faunal communities identified along the route.

Protected Habitats and Species of Conservation Importance

Intertidal Habitats and Species of Conservation Importance

2.7.27 Two intertidal habitats, mudflats and saltmarsh, identified at the Kent Landfall are listed as habitats of conservation importance as habitats of national conservation importance under Section 41 of the NERC Act (2006) (Table 2.13). The presence of potential habitats of conservation importance is discussed in further below and within **Application Document 6.3.4.2.C Appendix 4.2.C Intertidal Survey Report**. The survey also detailed that no species listed under Annex II of the Habitats Directive (2017a) or species of national conservation importance under Section 41 of the NERC Act (2006) were recorded. There are no other intertidal habitats within the Offshore Scheme, but there are intertidal sea caves on the Thanet coastline that are within the wider Study Area.

Intertidal mudflat

2.7.28 Intertidal mudflat is listed as a Habitat of Principal Importance under Section 41 of the NERC Act (2006) (Table 2.13). Mudflats are sedimentary intertidal habitats with sediments consisting mostly of silts and clays. Mudflats are distributed in estuaries and sheltered areas throughout the UK and are characterised by high biological productivity and abundance of organisms, but low diversity with few rare species. Mudflats are highly productive areas which, together with other intertidal habitats, can support large numbers of predatory birds and fish.

2.7.29 The intertidal survey of Pegwell Bay identified a variety of habitats, including intertidal mudflats (**Application Document 6.3.4.2.C Appendix 4.2.C Intertidal Survey Report**). Additionally, the Kent landfall is located within Leiston – Aldeburgh SSSI, which is designated for littoral sediments, and is 3.0 km from the Thanet Coast SSSI which is designated for the protection of mudflats. The landfall is also located within the Thanet Coast and Sandwich Bay Special Protection Area (SPA) (Table 2.15), of which mudflats are also noted as a supporting habitat for the qualifying ornithology features.

Coastal saltmarsh

2.7.30 Coastal saltmarsh is listed as a Habitat of Principal Importance under Section 41 of the NERC Act (2006) (Table 2.13). Coastal saltmarshes comprise the upper, vegetated portions of intertidal mudflats and are found throughout the UK, concentrated in estuaries and sheltered locations. Vegetation consists of a limited number of halophytic species adapted to regular immersion by the tides, with a natural saltmarsh system shows a clear zonation according to the frequency of inundation.

2.7.31 Saltmarshes are an important resource for wading birds and wildfowl. They act as high tide refuges for birds feeding on adjacent mudflats, as breeding sites for seabirds and waders. In Winter, grazed saltmarshes are used as feeding grounds by waterfowl. Moreover, due to the high structural and plant diversity bare particularly important for invertebrates. Saltmarshes also provide sheltered nursery sites for several species of fish.

2.7.32 The intertidal survey of Pegwell Bay that identified a variety of habitats, including coastal saltmarsh (**Application Document 6.3.4.2.C Appendix 4.2.C Intertidal Survey Report**). The Kent landfall is located with the Sandwich Bay to Hacklinge Marshes SSSI which is designated for the protection of saltmarsh (Table 2.15). However, the trenchless solution will act to completely avoid saltmarsh habitat, with the entry/exit point located between 105 and 140 m of the lower boundary of any saltmarsh.

Table 2.13 Summary of intertidal habitats of conservation importance identified from desk study and field surveys of the Sea Link Offshore Scheme, and their associated designations

Habitat	Associated biotope complex	Habitats Directive (2017) Annex I habitat	Section 41 of the NERC Act (2006)	Present within the Offshore Scheme	Present within the wider Study Area
Intertidal mudflats	**A2.3** Littoral mud		**X**	**Yes**	**Yes**
Coastal saltmarsh	**A2.5** Coastal saltmarshes and saline reedbeds		**X**	**No**	**Yes**
Submerged or semi-submerged sea caves	**A4.71** Communities of circalittoral caves and overhangs	**X**		**No**	**Yes**

Subtidal habitats and species of conservation importance

2.7.33 Several subtidal habitats identified within the Study Area are listed as habitats of conservation importance, either under Annex I of the Habitats Directive (2017a) or as habitats of national conservation importance under Section 41 of the NERC Act (2006) (Table 2.14)**.** The presence of potential habitats of conservation importance is discussed in further below and within **Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)**.

2.7.34 There are twelve invertebrate species nationally protected under the Wildlife and Countryside Act (1981). However, none of these was identified during the benthic survey (**Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)**.

Sandbanks which are slightly covered by seawater all the time

2.7.35 ‘Sandbanks which are slightly covered by sea water all the time’ (H1110) are an Annex I habitat listed under the Habitats Directive (2017a) (Table 2.14). This habitat is composed of sandy well-sorted substrates that form banks, which remain permanently covered by shallow sea water, typically occurring in water depths of <20 m below Chart Datum (JNCC, 2021). Sandbanks which are slightly covered by sea water all the time occur widely around the UK coast. Margate and Long Sands Special Area of

Conservation (SAC), located approximately 3.0 km from the Offshore Scheme, is designated for the protection of this habitat (JNCC, 2017a) (Table 2.15).

2.7.36 Subtidal sandbanks are high energy environments, subject to physical disturbance from strong tidal currents. The sediment type of these habitats is the key driver of the diversity and type of associated communities, as well as physical, chemical, and hydrographic factors (e.g., exposure, temperature, topography, depth, turbidity, and salinity). Although burrowing fauna such as worms, crustaceans, bivalve molluscs, and echinoderms typically colonise this habitat, fauna is generally sparse. Mobile shrimp, gastropods, crabs, and fish, including sandeel, may also be found. Where coarse sediments are stable, species of foliose algae, hydroids, bryozoans, and ascidians may be present.

2.7.37 During the benthic surveys of the Offshore Scheme, habitats indicative of Annex I 'sandbanks which are slightly covered by sea water all the time' were identified at several separate locations along the route (between KP61.7 and KP117.6) (**Figure 6.4.4.2.2 Subtidal Habitat Complexes and Annex I Habitats Identified within the Offshore Scheme Boundary** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**) though none were located within a designated site.

Communities on circalittoral rock

2.7.38 Two subtypes of 'Communities on soft circalittoral rock' (A4.23) - clay outcrops and soft chalk, were identified as potentially present in the Offshore Scheme on the basis of geophysical data. They have been mapped as such habitat as interpreted, on a precautionary basis, but were not extensive or indicative of habitats representative of high-quality examples of this habitat that support biodiverse faunal communities.

2.7.39 The data collected indicates the presence of scattered areas of outcropping clays or clay covered by a thin veneer of sand and/or gravel, to the north of the Kent offshore cable route. These were observed in scattered patches the northern and central parts of the route between KP7.5 and KP95.8, with similar features located towards the Suffolk landfall, between KP0.9 to KP1.5, in nearshore areas (**Appendix 4.2.A Benthic Characterisation Report (Original Report)**.

2.7.40 The habitat 'Peat and clay exposures' is distributed along the south and east coast of England, in intertidal areas, but little is known of the subtidal extent. The habitat can be difficult to assess with regards to distribution and extent due to periodic coverage of mobile sediments and subsequent emergence. 'Peat and clay exposures' are listed as 'Habitats of Principal Importance' under Section 41 of the NERC Act (2006) (Table 2.14). The biotope complex is also recognised as an irreplaceable habitat, particularly where the soft peat and clay supports a distinct biological assemblage, such as piddocks and red algae (Tillin, Watson, Tyler-Walters, Mieszkowska, & Hiscock, 2022).

2.7.41 The extent and distribution of these habitats within the Offshore Scheme was very patchy, and their observable presence is known to be subject to change as surrounding mobile sediments shift, covering and exposing various sections of clay. Where there is periodic coverage of a veneer of sediments this limits the presence of many species in these habitats and the development of the diverse communities that are of particular conservation importance. No biotopes indicative of complex biological habitats on peat and clay exposures were observed.

2.7.42 The soft chalk was primarily mapped in the southernmost areas, but well outside of the Thanet Coast MCZ, which is designated for a range of seabed habitats including subtidal chalk. Potential chalk habitat was mapped in a few small patches in the main survey route corridor between KP 101.109 and KP 127.298, in the region of the corridor approaching the Kent landfall.

2.7.43 Soft chalk was also noted in the geotechnical vibrocore samples (VC-63 to 70 and VC-73) collected along this section, occasionally appearing to be surficial but it was observed to be predominantly located below the surface. These small patches below the seabed will not support the faunal communities of burrowing bivalves and other species that may be characteristic of high-quality examples of this habitat. Soft chalk was identified primarily in the southernmost areas of the Offshore Scheme route between KP95.8 and the Kent Landfall. The habitat has been mapped on a highly precautionary basis. 'Subtidal chalks' are listed as 'Habitats of Principal Importance' under Section 41 of the NERC Act (2006) (Table 2.14) and an irreplaceable habitat, particularly for those that support diverse faunal communities.

2.7.44 Moderate energy circalittoral rock, which is animal-dominated rock found on deeper or shaded vertical rock faces is a protected feature of Goodwin Sands MCZ. This habitat supports a range of species including bryozoans, pink sea fans, cup corals, anemones, soft corals, sponges, sea squirts and red alga. The MCZ features map indicates this habitat is found to the east and south east of the MCZ, at least 10 km from the Offshore Scheme, but potentially within the ZOI for sediment dispersion.

Sea caves

2.7.45 The Thanet coast has the second most extensive representation of chalk caves in the UK (after Flamborough Head in Yorkshire). The 23 km of chalk cliffs contain a large number of partly-submerged caves and tunnels in the intertidal area. These caves support very specialised algal and lichen communities, some of which have not been recorded from anywhere else.

2.7.46 Sea caves are a designating feature of the Thanet Coast SAC, recorded from the northern region of Pegwell Bay and Dumpton Gap, just north of Ramsgate (Tittley, Spurrier, & Chimonides, 2002), outside the Offshore Scheme boundary. The caves are predominantly intertidal though there may be some that remain submerged at low tide.

Subtidal sands and gravels

2.7.47 Subtidal sands and gravels were observed at several grab sample stations as subtypes of the EUNIS biotopes A5.1 and A5.2 (**Figure 6.4.4.2.2 Subtidal Habitat Complexes and Annex I Habitats Identified within the Offshore Scheme Boundary** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). This broad habitat type is listed as a 'Habitat of Principal Importance' under Section 41 of the NERC Act (2006) (Table 2.14).

2.7.48 Subtidal sands and gravel sediments are the most common habitats found below the level of the lowest low tide around the coast of the United Kingdom. Subtidal Sands and Gravels are a wider habitat not limited to sandbanks but include other sandy and gravelly habitats. There is an overlap between this habitat and Annex I 'sandbanks which are slightly covered by sea water all the time' (1110), though none were located within a designated site.

2.7.49 The Offshore Scheme does not interact with any marine protected area specifically designated for the protection of subtidal sands and gravels.

Sabellaria spinulosa reefs

2.7.50 The Ross-worm (*S. spinulosa*) is a small, tube-building polychaete worm found in the subtidal and lower intertidal/subtidal fringe and is widely occurring across the UK. The project specific benthic surveys were undertaken to determine baseline characteristics and identify the presence of any notable and/or sensitive habitats. The location of sediment samples and video transects were based on a review of the geophysical data so that potential areas of habitats of principal importance, particularly biogenic reefs, would be specifically investigated. Small patches of *S. spinulosa* was identified at 11 grab sample stations within the Offshore Scheme Boundary during the Subtidal Characterisation Survey 2021 (S006, S007, S009, S010, S015, S017, S018, S019, S021, S036, and S037) (**Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)**). At stations S006 and S009 the habitat was assigned to the biotope '*Sabellaria spinulosa* on stable circalittoral mixed sediment'. However, a notable abundance of *S. spinulosa* tubes was observed at S009 only. This was the only station with *S. spinulosa* density above 375 individuals per 0.1 m^2, which is reported (FosterSmith and Sotheran, 1999 in Limpenny et al. (2010)) to be associated with reefs. However, the S009 samples did not contain clumps of *S. spinulosa* and it was observed as present as encrusting habitat only, not reef, with some overgrowth by *Mytilus edulis*.

2.7.51 When conditions are favourable, dense aggregations of worms can develop, forming biogenic reefs up to about 60 cm high and extending over several hectares (OSPAR Commission, 2013). *S. spinulosa* qualifies for conservation interest under Section 41 of the NERC Act (2006) where it forms reef features. An assessment of survey data in line with Jenkins *et al*. (2018) was carried out where aggregations of *S. spinulosa* were identified (e.g. Transect T004). A number of patches in this transect were noted where the structure of the *S. spinulosa* aggregations was assessed to fulfil the criteria of Low-Reefiness (Gubbay, 2007; Collins, 2010) (Table 84). However, based on the reefiness assessment combined with the geophysical data, which does not indicate the presence of reef formations, no areas meeting the qualifying criteria of Annex I (1170) – Biogenic Reefs were identified. Similarly, the additional surveys did not observe the presence of any Annex I *S. spinulosa* reef, concluding that any *S. spinulosa* aggregations were non-reef forming (**Application Document 6.3.4.2.D Appendix 4.2.D Additional Subtidal Survey Report (Additional Surveys)**). Therefore, the *S. spinulosa* biotopes identified in the Offshore Scheme do not meet the qualifying criteria of Annex I habitat 'biogenic reefs' (H1170) under the Habitats Directive (2017a), and the biotope does not qualify as a feature of conservation interest under the Section 41 of the NERC Act (2006).

2.7.52 Goodwin Sands Marine Conservation Zone (MCZ) is designated for the protection of 'Ross worm *Sabellaria spinulosa* reefs' (Defra, 2019b) (Table 2.15). However, the Offshore Scheme Boundary does not overlap with the Goodwin Sands MCZ, running directly adjacent to the boundary of the MCZ for approximately 3.2 km from KP107.3 to KP110.5. In addition, no *S. spinulosa* reefs were observed in this region of the Offshore Scheme. The Thanet Coast MCZ is also designated to protect 'Ross worm *Sabellaria spinulosa* reefs' (Table 2.15). However, this MCZ is located 1.2 km north of the Kent landfall site, beyond the Offshore Scheme Boundary.

Blue mussel beds

2.7.53 Mussel beds, of the species *Mytilus edulis*, are listed as a Habitat of Principal Importance under Section 41 of the NERC Act (2006) (Table 2.14). The species includes beds of mussels on some sediments, in various conditions. Blue mussel beds provide an area with enhanced biodiversity and play a key role in a healthy ecosystem.

2.7.54 During the 2021 benthic survey, blue mussels were observed at a number of sampling stations but were only present in mussel bed form around KP15 (grab sample station S007 and DDV transects T001, T001A and T004) in waters offshore of Suffolk (**Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)**). The grab and DDV data, together with the geophysical data was used to determine the nature of the mussel beds, which were found to comprise patches rather than a continuous reef, thus no Annex I (1170) – Biogenic Reef was identified in the original 2021 baseline survey.

2.7.55 Goodwin Sands MCZ is designated for the protection of 'blue mussel *Mytilus edulis* beds' (Table 2.15) and has a conservation objective to recover this feature. The Offshore Scheme Boundary does not overlap with the Goodwin Sands MCZ, instead, running directly adjacent to the boundary for approximately 3.2 km from KP107.3 to KP110.5, thus avoiding direct impacts on the blue mussel bed feature (**Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project**).

2.7.56 During the additional 2023 benthic survey blue mussels were observed in high density in DDV images (in two transects A5_OPB_05_HAS and A5_OPB_Add_01) in an area of the Offshore Scheme adjacent to Goodwin Sands MCZ (**Application Document 6.3.4.2.D Appendix 4.2.D Additional Subtidal Survey Report (Additional Surveys**). There were three patches in the transects that were identified as a potential mussel bed but they were not determined to be Annex 1 reef.

2.7.57 There are a number of other benthic habitats, outside of the Offshore Scheme, but within the wider Study Area and potential zone of influence, particularly in relation to potential increases in suspended sediment concentration and sediment deposition.

Table 2.14 Summary of subtidal habitats of conservation importance identified during the desk study and field surveys of the Sea Link Offshore Scheme, and their associated designations

Habitat	Associated biotope complex	Habitats Directive (2017) Annex I habitat	Section 41 of the NERC Act (2006)	Present within the Offshore Scheme	Present within the wider Study Area
Sandbanks which are slightly covered by sea water all the time	**A5.25** Circalittoral fine sand	**X***	**X**	**Yes**	**Yes**
Communities on circalittoral rock	**A4.23** Communities on soft circalittoral rock		**X**	**Yes**	**Yes**
	A4.2		**X**	**No**	**Yes**

Habitat	Associated biotope complex	Habitats Directive (2017) Annex I habitat	Section 41 of the NERC Act (2006)	Present within the Offshore Scheme	Present within the wider Study Area
	Moderate energy circalittoral rock				
Subtidal sand and gravels	**A5.1** Sublittoral coarse sediments **A5.2** Sublittoral sand		X	Yes	Yes
S. spinulosa reefs	**A5.611** *Sabellaria spinulosa* on stable circalittoral mixed sediment			No	Yes
Blue mussel beds	**A5.625** *Mytilus edulis* beds on sublittoral sediment	X*	X	No	Yes
Littoral rock	**A1.4** Submerged or partially submerged sea caves	X		No	Yes

** These habitats were not located within a European designated site or MCZ*

Invasive and Non-Native Species

2.7.58 Four non-native species, two of which are invasive to the UK, were recorded within the Offshore Scheme Boundary (**Appendix 4.2.A Benthic Characterisation Report (Original Report)**). These species were:

- Acorn barnacle *(Austrominius modestus)* is an invasive species to the UK and has a very well-established and long-standing presence around the coast of England and Wales and in a few locations in Scotland and Ireland (O'Riordan, Culloty, McAllen, & Gallagher, 2020). This species is found at all levels of the shore but is more common mid-shore and may extend to shallow sublittoral. Six individuals were found across two grab sample stations (S036 and S037) between KP111.7 and KP114.8, in shallow nearshore areas;
- *Eusarsiella zostericola* is a benthic ostracod with a known distribution throughout the east of England, including the Thames Estuary (Bamber, 1987). A total of 54 individuals were found across three grab sample stations: S005, S032,S033;
- Slipper limpet (*Crepidula fornicata*) is an invasive species first seen in the UK in 1872. The slipper limpet outcompetes other filter-feeding invertebrates and is now well established along much of the English coast (Blanchard, 1997). Four

individuals were found across three grab sample stations (S015, S017, and S019) between KP47.4 and KP75.7; and

- American piddock (*Petricolaria pholadiformis*) originates from North America and has been present in UK waters since 1890. There is no evidence that the species has displaced native piddocks and they are most commonly found off Essex and the Thames estuary (Bamber, 1985). A single individual was recorded at KP4.0 (S004).

Fish Supporting Habitat

2.7.59 Benthic conditions, particularly the type of sediment present, is an important determinant of the presence of spawning grounds for the benthic spawning sandeel and herring. For full details on fish spawning grounds, and potential impacts to this receptor from the Proposed Project see **Application Document 6.2.4.3 Part 4 Marine Chapter 3 Fish and Shellfish**.

2.7.60 An individual sandeel was collected in each of the grab sample at stations S016 and S022 (**Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)**). Raitt's sand-eel, *Ammodytes marinus*, is listed as a Species of Principal Importance under Section 41 of the NERC Act (2006). Further, lesser sand-eel, *Ammodytes tobianus,* is listed as DD (Data Deficient) by the IUCN Red List of Threatened Species (IUCN, 2021).

Chemical Analysis

2.7.61 Samples analysed for sediment chemistry were found to have levels of trace metals at all the sampling sites within the Offshore Scheme Boundary (**Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report**). However, none of the samples exceeded the CEFAS (MMO, 2014) Action Level (AL) 2 threshold. Analysis indicated that arsenic is the most prominent contaminant within the current survey, exceeding CEFAS (MMO, 2014) AL 1 threshold value at 15 of the grab sample stations, and the CCME Interim Sediment Quality Guidelines (ISQG) (CCME, 2001) assessment criteria at 32 sites. One of the sites, KP8.7 exceeded the CCME Probable Effect Level (PEL) (CCME, 2001) the level at which a substance is expected to have frequent adverse effects on aquatic ecosystems. However, previous studies have also demonstrated high concentrations of arsenic in several areas of the North Sea, including the outer Thames estuary (London Array Limited , 2005), indicating high background levels.

2.7.62 The highest concentrations of lead and copper were measured at sample station S036, approximately 5 km southeast of the port of Ramsgate, exceeding both CEFAS (MMO, 2014) AL 1 and CCME ISQG assessment criteria (CCME, 2001), with lead exceeding CCME PEL assessment criteria. However, as the neighbouring survey sample stations have concentrations that do not exceed any thresholds, an explanation for the high concentrations of copper and lead could be the presence of many former licensed dredge spoil disposal sites in the area, combined with a sediment transport prediction made by CEFAS regarding the material disposed within Pegwell Bay and the Port of Ramsgate (CEFAS, 2001). Since then, many more disposal sites have come into existence in the area, possibly increasing the distribution of contaminants.

2.7.63 It was found that the levels of metals showed no geographical trends and did not correlate with sediment composition, total organic carbon (TOC), or organic matter. The concentration of TOC and organic matter varied along the survey route. Polycyclic aromatic hydrocarbon (PAH) concentrations exceeded CEFAS (MMO, 2014) AL 1 and CCME ISQG (CCME, 2001) threshold values for three PAHs at one grab sample station within the Offshore Scheme Boundary, located at approximately KP5.3. Overall, concentrations were noted to be higher at the northern sites of the Offshore Scheme, but no correlation was found with either TOC, organic matter, or sediment composition. Overall, concentration levels from within the survey area were found to be typical of those found in the wider region and were not observed at levels that are of concern.

Designated Sites

2.7.64 The key sites designated for the protection of benthic features within the benthic ecology Study Area, comprise four SACs, two SPAs, four MCZs, and three SSSIs. These are listed below in Table 2.15 and shown on **Figure 6.4.4.2.1 Benthic Ecology Study Area and Relevant Designated Sites** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**.

2.7.65 Impacts to SACs and SPAs are detailed in **Application Document 6.6 Habitats Regulations Assessment Report**. Similarly, for further detail regarding impacts to MCZ, see **Application Document 6.11 Marine Conservation Zone Assessment**.

Table 2.15 Sites designated for benthic ecology

Site name	Distance from Offshore Scheme (km)	Summary
Leiston-Aldeburgh Site of SSSI	0	The SSSI covers the intertidal area of the landfall at Thorpeness. The site is designated for a range of habitats including wetlands, heathland, and woodlands, as well as a range of breeding and non-breeding bird features. The intertidal area is largely comprised of sandy habitat with a section of ‘coastal vegetated shingle’, a habitat of ‘principal importance’ under Section 41 of the NERC Act (2006). Cables will be installed between the marine environment and onshore via a trenchless solution. There will be no activities in the intertidal environment, and thus, this site is not considered further. Impacts to terrestrial features are assessed in **Application Document 6.2.2.3 Part 2 Suffolk Chapter 3 Ecology and Biodiversity.**
Outer Thames Estuary SPA	0	The Offshore Scheme crosses the SPA at three separate locations. The SPA was designated to protect a large wintering population of red-throated diver, *Gavia stellata*, breeding populations of common tern, *Sterna hirundo,* and little tern, *Sternula albifrons* (JNCC, 2017b).

Site name	Distance from Offshore Scheme (km)	Summary
		The grab sample stations located within the SPA, KP4.1 and KP75.8 (S004 and S019), are classified as 'Marginal' for sand eels. Sand eels are an important food source for many seabirds, including those protected by the SPA. Impacts to ornithological features are assessed in **Application Document 6.2.4.5 Part 4 Marine Chapter 5 Marine Ornithology.**
Southern North Sea SAC	0	The Offshore Scheme crosses the SAC at three separate locations. The SAC is designated to protect harbour porpoise, *Phocoena phocoena* (JNCC, 2019). This species is known to prefer foraging in areas of coarse sediment, like sand and gravel, over fine sediment such as mud. Based on the grab sample stations located within the SAC, the sediment consisted mainly of sand and gravel. Impacts to marine mammal features are assessed in **Application Document 6.2.4.4 Part 4 Marine Chapter 4 Marine Mammals**.
Orford Inshore MCZ	8.6	This site is located to the east of the Suffolk Landfall and is designated for the protection of 'subtidal mixed sediments'. Subtidal mixed sediments were identified between KP10.3 and KP25.0 of the Offshore Scheme. However, these observations were made beyond the boundary of the MCZ.
Margate and Long Sands SAC	3.0	Located west of the Offshore Scheme, designated for the protection of the Annex I habitat 'sandbanks which are slightly covered by sea water all the time' (JNCC, 2017a). There were several large areas indicative of this Annex I habitat identified along the Offshore Scheme, none of which were located within this SAC. However, it is worth noting the dynamic and mobile nature of the fine sediment associated with this protected feature.
Kentish Knock East MCZ	1.0	This site is located to the east of the central part of the Offshore Scheme and is designated for the protection of 'subtidal sand', 'subtidal coarse sediment', and 'subtidal mixed sediment'. The Offshore Scheme was found to be dominated by subtidal mixed sediments. These observations were made beyond the boundary of the MCZ.
Thanet Coast MCZ	1.1	The MCZ is located north of the Kent landfall site, west of the Offshore Scheme, and is designated to protect 'blue mussel *Mytilus edulis* beds', 'moderate energy circalittoral rock', 'moderate energy infralittoral rock', 'peat and clay

Site name	Distance from Offshore Scheme (km)	Summary
		exposures', 'Ross worm *Sabellaria spinulosa* reefs, 'stalked jellyfish *Calvadosia cruxmelitensis*' '*Haliclystus* spp.', 'subtidal chalk', 'subtidal coarse sediment', 'subtidal mixed sediments', and 'subtidal sand' (Defra, 2019b). The Subtidal Characterisation Survey 2024 at this section of the Offshore Scheme closest to this MCZ did not identify any of the protected features of the site. However, subtidal sand, mixed sediments, and juvenile blue mussel these were identified beyond the boundaries of the MCZ.
Thanet Coast SAC	0	The Offshore Scheme intersects Thanet Coast MCZ near the Kent Landfall, this SAC is designated for the protection of 'reefs' and 'submerged or partially submerged sea caves'.
Thanet Coast SSSI	3.0	The Thanet Coast SSSI is located to the north of the Kent landfall site, and is designated for the protection of foreshore habitats, such as sand and mudflats and smaller areas of saltmarsh and coastal lagoons. Impacts to terrestrial features are assessed in **Application Document 6.2.3.3 Part 2 Kent Chapter 3 Ecology and Biodiversity**.
Sandwich Bay SAC	0	Covers the intertidal area of Pegwell Bay, where the Kent Landfall is located. However, this site is designated for the protection of a range of dune habitats located above MHWS. Impacts to terrestrial features are assessed in **Application Document 6.2.3.3 Part 2 Kent Chapter 3 Ecology and Biodiversity.**
Thanet Coast and Sandwich Bay SPA	0	The Offshore Scheme crosses the SPA between KP118.7 and the Kent Landfall. The SPA is designated to protect a breeding population of little tern, *Sternula albifrons,* and wintering populations of European golden plover, *Pluvialis apricaria,* and ruddy turnstones, *Arenaria interpres* (JNCC, 2015). The designated features of this site rely on species such as herring or sandeel as prey. Although, none of the sample stations located within the SPA comprised a sediment composition suitable for sandeel or herring spawning. Impacts to ornithological features are assessed in **Application Document 6.2.4.5 Part 4 Marine Chapter 5 Marine Ornithology** and impacts to herring and sandeel spawning habitats are assessed in **Application Document 6.2.4.3 Part 4 Marine Chapter 3 Fish and Shellfish**.

Site name	Distance from Offshore Scheme (km)	Summary
Sandwich Bay to Hacklinge Marshes SSSI	0	The Sandwich Bay to Hacklinge Marshes SSSI covers the intertidal area of Pegwell Bay, where the Kent Landfall is located. This site is designated for the protection of a range of terrestrial habitats and species, as well as saltmarsh and littoral sediment. Cables will be installed between the marine environment and onshore via a trenchless technique and will completely avoid saltmarsh habitats, thus, this site will not be considered further. Impacts to terrestrial features are assessed in **Application Document 6.2.3.3 Part 2 Kent Chapter 3 Ecology and Biodiversity**.
Goodwin Sands MCZ	0	The MCZ is designated for the protection of 'subtidal coarse sediment', 'subtidal sand', 'blue mussel beds', 'moderate energy circalittoral rock' and 'Ross worm *Sabellaria spinulosa* reefs' (Defra, 2019a). The Offshore Scheme has been re-routed to completely avoid the Goodwin Sands MCZ, running directly adjacent to the boundary to that of the MCZ, for 3.2 km from approximately KP107.3 to KP110.5.

Summary of Receptors

2.7.66 The benthic ecology receptors taken forward for consideration in the appraisal have been determined based upon the potential interactions between benthic receptors and the project activities identified in Table 2.16.

Table 2.16 Benthic ecology receptors and their assigned value

Receptor group	Description	Rationale	Value
Benthic habitats	Sandbanks which are slightly covered by seawater all the time	• Annex I habitat, does not overlap with Offshore Scheme; • NERC Section 41 habitat; and • Have some capacity to absorb change.	**High**
	Communities on circalittoral rock	• NERC Section 41 habitat.	**Medium**
	Subtidal sands and gravels	• NERC Section 41 habitat. • Protected feature of Goodwin Sands MCZ;	**Medium**

Receptor group	Description	Rationale	Value
		• Have some capacity to absorb change; and • Common and widespread habitats.	
	Blue mussel beds	• Annex I habitat, does not overlap with Offshore Scheme; • NERC Section 41 habitat; and • Protected feature of Goodwin Sands MCZ	**High**
	Intertidal mudflats	• NERC Section 41 habitat; • Have some capacity to absorb change; and • Common and widespread habitats.	**Medium**

Future Baseline

2.7.67 The lifetime of the Proposed Project is 40 - 60 years. During this lifetime, the benthic ecology baseline can be expected to evolve both on a natural basis, and in response to global trends such as climate change and other anthropogenic activities (e.g. ocean acidification, fisheries, eutrophication, offshore development) (Walther, et al., 2002).

2.7.68 Climate change impacts on benthic ecology can be direct (e.g., increase in sea level or seawater temperatures) or indirect (e.g., changes in storminess, wave climates and hydrodynamics). Of the potential impacts of climate change, sea level rise and increased seawater temperatures are the dominant factors. The scale of impacts and the degree of baseline evolution is dependent on the sensitivity of the habitats present and the magnitude and nature of climate and associated environmental changes (Harrison, Berry, & Dawson, 2001). Benthic habitats within the intertidal and shallow subtidal zones are considered most sensitive, as well as habitats such as *S. spinulosa* reefs which are expected to be negatively impacted by increases in storm activity (Jackson & Hiscock, 2008).

2.7.69 Benthic species possessing a planktonic phase in their life history are predicted to be most sensitive to increased seawater temperatures (Hiscock, Southward, Titley, Jory, & Hawkins, 2001). Boreal-arctic species at the southern limits of their range will likely decline or disappear whilst species at the northern limit of their range could increase in abundance and distribution. Secondary impacts may also be observed, with species abundance and distributional changes occurring due to changes in their grazers or predator’s abundance.

2.7.70 There is significant uncertainty surrounding the impacts of climate change on benthic ecology around the UK, particularly for sediment substrates as these are often highly dynamic in nature with associated benthic ecology exhibiting significant natural variability. Although detectable changes in baseline conditions may be observed over the lifetime of the Proposed Project, these are not anticipated to occur prior to completion of construction and so there would be no change to the assessment of effects for this project phase. Any changes during operation and maintenance and decommissioning are likely to be small and are therefore not expected to alter the conclusions of the assessments.

2.8 Proposed Project Design and Embedded Mitigation

2.8.1 The Proposed Project has been designed, as far as possible, following the mitigation hierarchy to, in the first instance, avoid or minimise environmental impacts and effects, including to benthic features, through the process of design development, and by embedding measures into the design of the Proposed Project.

2.8.2 As set out in **Application Document 6.2.1.5 Part 1 Introduction Chapter 5 EIA Approach and Methodology**, mitigation measures typically fall into one of the three categories: embedded measures; control and management measures; and mitigation measures.

Embedded Measures

2.8.3 Embedded measures have been integral in reducing the benthic ecology effects of the Proposed Project. Measures that have been incorporated are:

- Sensitive routeing and siting of infrastructure and temporary works; and
- Commitments made within **Application Document 7.5.3.2 CEMP Appendix B Register of Environmental Actions and Commitments**.

Control and Management Measures

2.8.4 The following measures have been included within **Application Document 7.5.3.1 CEMP Appendix A Outline Code of Construction Practice** relevant to the control and management of impacts that could affect benthic ecology receptors:

- BE01 - a biosecurity plan will be produced for the project, following the latest guidance on INNS from the Great Britain Non-Native Species Secretariat;
- BE02 - all project vessels will adhere to the International Maritime Organisation (IMO) Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species (Biofouling Guidelines 2011);
- BE03 - any material introduced into the marine environment, such as rock protection material, will be from a suitable source or cleaned to ensure no INNS can be introduced;
- BE04 – Where possible, cable protection materials will use locally sourced materials or environmentally benign sources;
- FSF01 - The target depth of lowering will be between 1 m to 2.5 m (subject to local geology and obstructions);
- LVS01 - all project vessels shall adhere to the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (BWM Convention);
- LVS02 - all project vessels must comply with the International Regulations for Preventing Collisions at Sea (1972) (IMO, 1972) regulations relating to International

Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73/78) (IMO, 1983) with the aim of preventing and minimising pollution from ships and the International Convention for the Safety of Life at Sea (IMO, 1974);

- LVS04 - All oil, fuel and chemical spills will be reported to the MMO Marine Pollution response team;
- LVS05 - drilling fluids required for trenchless operations will be carefully managed to minimise the risk of breakouts into the marine environment. Specific avoidance measures would include:
  - the use of biodegradable drilling fluids (PLONOR substances) where practicable,
  - drilling fluids will be tested for contamination to determine possible reuse or disposal; and
  - If disposal is required drilling fluids would be transported by a licensed courier to a licensed waste disposal site.
- GG15 - Fuels, oils and chemicals will be stored responsibly, away from sensitive water receptors;
- GM01 - designated (and as minimal as possible) anchoring areas and protocols shall be employed during marine operations to minimise physical disturbance of the seabed;
- GM03 - an offshore Construction Environmental Management Plan (CEMP) including an Emergency Spill Response Plan and Waste Management Plan, Marine Pollution Contingency Plan (MPCP), Shipboard Oil Pollution Emergency Plan (SOPEP) and a dropped objects procedure will be produced prior to installation; and
- MPE03 - Cable protection features (e.g. rock placement, mattresses and grout bags) will be installed only where considered necessary for the safe operation of the Project. This includes the repair of cables due to accidental damage.

2.9 Assessment of Impacts and Likely Significant Effects

2.9.1 The assessment of the effects of the Offshore Scheme on benthic ecology receptors described in this section considers the impact with embedded, control and management measures, as described in Section 2.8, being in place.

Table 2.17 Summary of impact pathways and maximum design scenario

Potential Impact	Maximum Design Scenario
Construction	
Temporary physical disturbance to benthic habitats and species	**Suffolk Landfall** Total area of 0.0002 km^2 of disturbance from the following: • use of jack-up barge (JUB) at 4 HDD entry/exit point locations (50 m^2 at each HDD entry/exit point location).
	Kent Landfall

Potential Impact	Maximum Design Scenario
	Total area of 0.0721 km^2 of disturbance from the following: • cofferdams and HDD exit pits will be located within a designated working area of 0.0216 km^2 (120 x 180 m) in the upper intertidal. Construction of the cofferdams is estimated to take 28 days (7 days per cofferdam). Each of the cofferdams will be in place for 30-60 days, with a total duration of 120 days. • This includes 0.00036 km^2 from the temporary placement of concrete mattresses/rock bags at HDD entry/exit points. Assumed to be five per HDD exit (worst-case scenario measuring 0.45 m x 3.0 m x 6.0 m). These will be removed approximately 1 week before cable pull-in, before permanent protection will be buried at the same location, leading to the same area of temporary disturbance; • 0.0002 km^2 of disturbance from use of JUB or back-hoe dredger at 4 HDD entry/exit point locations (50 m^2 at each HDD entry/exit point location); • 0.0003 km^2 of disturbance from the use of a cable lay barge and associated anchoring (8 x anchors each with 32 m^2 footprint each and berthed barge). The cable barge will be in place for a period of up to 32 days; and • Superficial disturbance of the mudflats within the LoD from the movement of plant and vehicles during construction programme, including to and from the hoverport. The MDS is up to 20 construction plant/vehicles at any one time (based on cable pull in) and 40 movements per day, at peak times. All vehicles removed from the intertidal daily. There will be placement of temporary ground protection mats between the hoverport and the HDD work area; • Trenching for cable installation in Pegwell Bay, assuming unbundling of the two cables at MLWS and buried in separate trenches (2 x 20 m) for a distance of 1,250 m to HDD, gives estimated area of disturbance of 0.05 km^2 for two cables
	Offshore Scheme installation A number of pre-installation and cable installation activities will temporarily disturb seabed habitats. These activities include: • 0.36 km^2 of disturbance from the pre-lay grapnel run (maximum swathe of 3 m up to a length of 120 km);

Potential Impact	Maximum Design Scenario
	• 0.35 km^2 of disturbance from sand wave lowering (pre-sweeping) (maximum swathe 20 m over a length of 17.56 km between KP96.32 to KP113.883)[2]; • 3.01 km^2 of disturbance from cable trenching (from Suffolk HDD pits to MLWS at Pegwell Bay. This may include various methods including ploughing[3], jet trenching, and/or mechanical trenching (maximum swathe of 25 m over a length of up to 122 km).
Temporary increase in SSC and sediment deposition leading to increased turbidity and smothering effects and possible contaminant mobilisation	Based on modelling undertaken in **Application Document 6.2.4.1 Part 4 Marine Chapter 1 Physical Environment**, the highest dispersion is associated with the use of jetting during cable installation.
Changes to marine water quality during cable installation and cable lay from the use of drilling fluids	**Suffolk Landfall** Up to 7,240 m^3 of drilling fluid discharged at 4 HDD entry/exit point locations (1,810 m^3 per HDD entry/exit point)
	Kent Landfall Up to 40 m^3 of drilling fluid discharged at 4 HDD entry/exit point locations (10 m^3 per HDD entry/exit point)
Underwater sound impacts on marine invertebrates	The activities associated with the Proposed Project include: • MBES – operating frequency 170 – 450 kHz; • SSS - operating frequency 300 – 600 kHz; • SBP – operating frequency of 0.5 - 12 kHz; • USBL – operating frequency of 21 – 31 kHz; • Cable installation – operating frequency of 1 - 15 kHz; • Cable lay vessel (operating with dynamic positioning) – operating frequency of 0.005 - 3.2 kHz; • Support vessels – operating at a variety of frequencies, as vessels are continuously moving, any impacts will be transient and short term; and

[2] There is no separate designated disposal area, the sand will be deposited within the Offshore Scheme Boundary within the area of pre-sweeping in such a way that the local currents will not backfill the pre-sweep area prior to cable installation and protection. The mechanism to infill the rock trench and allow the seabed to revert to natural bedforms is by natural backfill and sediment circulation / deposition.

[3] Displacement plough and jet plough are considered unlikely methods to be used. However, the swathe of displacement plough (up to 25 m) has been used in the assessment as a worst-case scenario.

Potential Impact	Maximum Design Scenario
	• Clearance of UXO - the loudest source of underwater sound that could be generated by the project, with a large impact radius.
Operation & Maintenance	
Direct loss of subtidal benthic habitats and species due to placement of hard substrates on the seabed	Total area of 0.18 km^2 of permanent loss of habitat from the following options for external cable protection: • In areas identified as high-risk for cable strike - 38 km of the Offshore Scheme from KP35 to KP58, and KP81.5 to KP96.5 – there will be 0.0456 km^2 of habitat loss from rock backfill • In areas of low-risk for cable strike, excluding areas of trenchless techniques at landfall, the placement of remedial rock berms is estimated to be required for 15% of the Offshore Scheme, which is 12,000 m. Rock berms will be up to 7 m wide (no lowering) at the base giving a total area of loss of 0.084 km^2. • 0.00036 km^2 loss from the burial of concrete mattresses at Suffolk Landfall. • 0.05 km^2 of loss from concrete mattresses/rock berm protection at cable crossings. There are ten in-service cable crossings that will require protection (maximum footprint of 0.005 km^2 per crossing).
Introduction and spread of INNS via the addition of cable protection	A total area of 0.18 km^2 of cable protection is expected as: • Remedial rock berm over a length of 12 km with a total area of 0.084 km^2; • Rock backfill over a length of 38 km with a total area of 0.0456 km^2; • Concrete mattresses at HDD exit points (total area of 0.00072 km^2 across both landfalls); and • Rock protection at ten cable crossings (total area of 0.05 km^2).
Effects from thermal emissions	Proposed project has committed to the installation of two bundled HVDC cables.
Effects of EMF emissions	Proposed project has committed to the installation of two bundled HVDC cables.

Potential Impact	Maximum Design Scenario
Maintenance effects	The Offshore Scheme is designed for a lifespan of approximately 40 - 60 years. The cable system installation is designed such that a regular maintenance regime is not required to maintain the integrity of the link. See route preparation and cable installation, noting that durations and extents of activities will be significantly reduced.
Decommissioning	
Decommissioning effects	Offshore and landfall working hours will be continuous (24/7). An initial decommissioning plan will be written once the final route and installation methodology is engineered by the Contractor. This will be in accordance with all applicable legislation and best practice guidance at the time of compilation. Dependent on requirements at end of asset life, the redundant cables could either be recovered for recycling (in its entirety, or in parts), or left in-situ.

Construction Phase

Temporary physical disturbance to habitats and species

2.9.2 There are a number of landfall, route preparation, and cable installation activities that will result in temporary physical disturbance to intertidal and subtidal benthic habitats and species (Table 2.17).

2.9.3 Sensitivity to the impact of habitat disturbance varies between habitats and species, depending on the stability of the habitat and its resilience to disturbance, and the vulnerability of individual species to mechanical disturbance.

2.9.4 The total area of expected temporary disturbance at the Suffolk Landfall is 0.0002 km^2 and the Kent Landfall is 0.072 km^2, and the largest area of temporary disturbance in the Offshore Scheme associated with cable trenching is 3.01 km^2 (Table 2.17). This gives the total area of temporary disturbance from the Offshore Scheme to be 3.08 km^2. This represents a worst-case scenario, assuming equipment with the largest footprint will be used throughout the construction phase.

Sensitivity

2.9.5 At the Suffolk Landfall, the entry/exit points will be entirely in the subtidal environment within a mud habitat (**Figure 6.4.4.2.4 Habitats Present at, and Location of, Trenchless Solution Entry/Exit Points** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). This habitat is likely to support infaunal communities that have a high resilience to temporary disturbance (De-Bastos & Watson, 2023) and as such the sensitivity is considered to be low.

2.9.6 At the Kent Landfall, the entry/exit points will be located within the intertidal range, located within an area of mudflat (**Figure 6.4.4.2.4 Habitats Present at, and Location of, Trenchless Solution Entry/Exit Points** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). Intertidal mudflat is listed as a Habitat of Principal Importance under Section 41 of the NERC Act (2006). However, infaunal species associated with these habitats, such as *L. conchilega*, *M. balthica* and *H. diversicolor*, exhibit rapid recovery to disturbance (McQuillan, et al., 2024; Tillin, et al., 2024). Therefore, intertidal mudflats have a low sensitivity to temporary physical disturbance.

2.9.7 The seabed in the Offshore Scheme is characterised by six broadscale habitat complexes: Atlantic and Mediterranean moderate energy circalittoral rock; sublittoral coarse sediments; sublittoral sand; sublittoral mud; sublittoral mixed sediments; and sublittoral biogenic reef. Within these some habitats of conservation importance have been identified.

2.9.8 Habitat indicative of Annex I 'sandbanks which are slightly covered by sea water all the time', was observed within the Offshore Scheme, although these are not specifically protected under any designated site. Margate and Long Sands SAC, 3.0 km west of the Offshore Scheme, is the nearest site designated for the protected of Annex I sandbanks (JNCC, 2017a). A detailed routing and siting study was undertaken to ensure the complete avoidance of the Annex I habitat features within Margate and Long Sands SAC (**Application Document 8.1 Historic Report 1 (CPRSS)**. Moreover, according to Admiralty charts, the Offshore Scheme also completely avoids the major sandbanks in the Thames Estuary (**Figure 6.4.4.2.6 Location of the Offshore Scheme in Relation to Admiralty Chart of the Thames Estuary** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). Sandbanks in shallow water are subject to significant wave and tidal energy, are often low in biodiversity because of the natural disturbance regime, and so are considered to have high capacity to tolerate physical disturbance (Elliot, et al., 1998). This habitat is therefore, considered to have low sensitivity to temporary disturbance.

2.9.9 Within the Offshore Scheme there are two additional NERC habitats of principal importance – 'communities on circalittoral rock' and 'subtidal sands and gravels'. None of the patches of these habitats found within the Offshore Scheme are specifically protected by a designated site and routing and siting studies ensured the absence of any direct impact on such habitats specifically protected by Marine Protected Areas. but are still considered to be of medium value. Biotopes associated with sands and gravels are understood to be characterised by species that are relatively tolerant of disturbance of the sediments (Caprasso, Jenkins, Frost, & Hinz, 2010). For many infaunal species, displacement will have only a temporary impact as fauna will be able to redistribute once the installation spread has moved away. However, circalittoral rock, including peat and clay exposures and soft chalk biotopes, can support a higher diversity, with epifaunal communities that are likely to be more vulnerable to physical disturbance. Epifaunal species are generally unable to move away and so are vulnerable to physical disturbance, as is soft rock. These habitats are, therefore, considered to have medium sensitivity to temporary disturbance.

2.9.10 Moreover, during the benthic surveys, *M. edulis* beds on sediment were identified at two locations within the Offshore Scheme Boundary. These mussel beds are listed as a Habitat of Principal Importance under Section 41 of the NERC Act (2006). Mussel beds were identified in the Offshore Scheme adjacent to Goodwin Sands MCZ (at KP109) (**Application Document 6.3.4.2.D Appendix 4.2.D Additional Subtidal Survey Report (Additional Surveys)**) but were not identified as Annex I habitat 'biogenic reefs' (H1170). Annex I mussel bed habitat was not observed anywhere else within the

Offshore Scheme Boundary and at the single location where it was observed is not specifically protected. Nor is it protected under any other designated site. Evidence reviewed as part of the Marine Evidence based Sensitivity Assessment (MarESA) found *M. edulis* on sediment habitats to have medium sensitivity to disturbance (and abrasion) to both the surface and the subsurface of the substratum (Tillin, Mainwaring, Tyler-Walters, Williams, & Watson, 2024). On this basis, the species is noted as having a medium sensitivity to temporary disturbance.

2.9.11 The presence of *S. spinulosa* was also observed within the Offshore Scheme Boundary, but similarly reef formations were not identified (Gubbay, 2007). *S. spinulosa* can be tolerant to physical disturbance with the species having the ability to repair tubes (Vorberg, 2000). Additionally, high levels of recruitment indicate rapid recovery to limited levels of disturbance (Jackson & Hiscock, 2008). Nevertheless, *Sabellaria spinulosa* reefs have been considered to have a medium sensitivity to this impact pathway, particularly where stable reef structures are present.

2.9.12 The Offshore Scheme Boundary runs parallel to the Goodwin Sands MCZ, running directly adjacent to the boundary for approximately 3.2 km between KP107.3 to KP110.5, ensuring avoidance of the designated features of the site. Therefore, no temporary loss of habitats is anticipated within Goodwin Sands MCZ.

2.9.13 The remaining habitats within the Offshore Scheme comprise subtidal muds and mixed sediments, which are widespread in this region of the North Sea and so are considered to be of low value. The communities in these habitats are likely to be dominated by infauna, that can tolerate some physical disturbance, and so are also considered to have low sensitivity to temporary disturbance.

2.9.14 Most animals that are sediment dwelling may be disturbed during construction when seabed preparation activities such as sand wave levelling - which may include ploughing or jetting to move sediment aside to an adjacent location - are carried out. As sediments are displaced in advance of cable laying and backfilled after the export cable is laid, there may be some loss and/or disturbance of larger and less mobile species, but only relatively low numbers of individuals are expected to be affected. For many infaunal animals, displacement will have only a temporary impact, and fauna is assumed to be able to redistribute within the sediment following completion of construction. As a result, recovery of habitats is expected to be relatively rapid.

Magnitude of impact

2.9.15 The use of a JUB at the Suffolk Landfall will lead to the temporary disturbance of 0.0002 km^2 of subtidal mud. This habitat is likely to support infaunal communities that can recover from temporary disturbance (De-Bastos & Watson, 2023). Moreover, the area of disturbance is very limited, with subtidal muds understood to be extensive throughout the wider North Sea, and as such the physical disturbance and/or temporary loss of this habitat is predicted to be of small magnitude.

2.9.16 At the Kent Landfall, the use of an excavator, JUB or back hoe dredger, cable lay barge, and temporary cofferdam will lead to the temporary disturbance of 0.0721 km^2 of intertidal mudflat. It is anticipated it will take up to seven days to install a cofferdam around a single HDD exit pit, giving a total duration of 28 days. If HDDs are constructed sequentially, there will be breaks of seven to 21 days between each cofferdam construction. Each cofferdam would be potentially in place for 30 to 60 days. The programme for these works is 2-3 months which includes preparatory works. Moreover, concrete mattresses/rock bags will be placed at the HDD entry/exit points which will then be removed approximately 1 week before cable pull-in, before permanent protection will be buried at the same location, temporarily disturbing the mudflat. The cable pull-in and burial activities are expected to take 16 days, for a single bundled cable, or if unbundled two periods of 16 days, up to 30 days apart. Thus, the duration of the Pegwell Bay installation activities, and hence disturbance to the mudflats, is periodic and short-term. Where small areas of sediment are excavated for the cofferdam and the cable trenching and burial these will be backfilled. All disturbance from other activities is to the surface of the mudflats only, limited to tracks and shallow indentations which will be undetectable after a single, or at most, a few tidal cycles. The placement of protective mats between the hoverport and the HDD work area will minimise disturbance to the mudflat from transiting plant and vehicles. A detailed description of the construction works in Pegwell Bay is provided in **Application Document 9.13 Pegwell Bay Construction Method Technical Note** submitted at Deadline 1.

2.9.17 The Kent Landfall is in Pegwell Bay, Kent, where intertidal mudflats cover most of the intertidal area. During installation, the footprint of disturbance will be limited and temporary. Additionally, although disturbance will occur a second time during the burial of the permanent protection, this will also only have a temporary effect as fauna associated with these habitats are generally restricted to the top 30 cm of sediment (Ashley, Budd, Lloyd, & Watson, 2024), and thus recolonization is anticipated to be rapid (Lewis, Davenport, & Kelly, 2002). Therefore, due to the temporary and limited footprint compared to wider available area of habitat, and the understood ability for infaunal species associated with intertidal mudflat to exhibit rapid recovery to disturbance (McQuillan, et al., 2024; Tillin, et al., 2024), the physical disturbance and/or temporary loss of this habitat is predicted to be of small magnitude.

2.9.18 Temporary disturbance as a result of Construction Phase activities will occur along the entire Offshore Scheme (a maximum of ~ 122 km in length). Cable trenching would result in the widest disturbance swathe, of up to 25 m. The length over which this method will be employed is currently unknown. However, for a worst-case estimate and to encompass any temporary disturbance by other cable installation methods, it is assumed that this will be for the entire length of the cable. In this scenario, the total area of temporary disturbance will be 3.01 km^2.

2.9.19 ‘Subtidal sands and gravels’ were identified at 12 sites across the Offshore Scheme during the Subtidal Characterisation Survey 2021 (**Appendix 4.2.A Benthic Characterisation Report (Original Report**) and are known to be extensive along the adjacent coastline and wider North Sea area (EMODnet, 2021). Temporary physical disturbance is therefore likely to have a negligible effect on the wider distribution and extent of these benthic habitats, and thus have a small magnitude of effect. Furthermore, it is understood that the biological assemblage present in this biotope is characterised by species that are relatively tolerant of penetration and disturbance (Caprasso, Jenkins, Frost, & Hinz, 2010) and sediments would be expected to recover from penetration, abrasion and disturbance, returning to baseline conditions within a short period of time (expected to be <12 months) (RPS, 2019). Due to the temporary and localised nature of installation activities and the small-scale installation footprint compared to wider available area of habitat, the physical disturbance and/or temporary loss of this habitat is predicted to be of small magnitude.

The habitat type ‘Communities on circalittoral rock’, which includes peat and clay exposures and soft chalk, was identified in very small patches throughout the Offshore Scheme (**Appendix 4.2.A Benthic Characterisation Report (Original Report)**) though not in any designated site. This habitat was the least common broadscale habitat seen throughout the Offshore Scheme but was identified in higher concentrations in nearshore areas close to both landfalls, particularly around KP11.0 and KP118.0 (**Figure 6.4.4.2.2 Subtidal Habitat Complexes and Annex I Habitats Identified within the Offshore Scheme Boundary** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**).

Biogenic reef biotopes, of species such as *S. spinulosa* and *M. edulis*, were also identified in limited areas (e.g., between KP8.7 and KP14.2) (**Figure 6.4.4.2.2 Subtidal Habitat Complexes and Annex I Habitats Identified within the Offshore Scheme Boundary** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). Both biogenic reef types were observed only in small patches, at only a few locations, and were not classified as Annex I biogenic reef anywhere within the Offshore Scheme. In addition, these habitats are not specifically protected under any designated site in the survey corridor due to careful routing and siting of the cable.

Considering the temporary and localised nature of installation activities and the small-scale installation footprint compared to wider available area of habitat and the absence of any Annex 1 habitats within the Offshore Scheme, the physical disturbance and/or temporary loss of all seabed habitats is predicted to be of small magnitude. Where physically sensitive habitats such as peat and clay exposures and soft chalk are present the footprint of effect is also small in relation to the overall extent.

The Applicant will be required to complete pre-construction surveys to inform final cable route design and installation. Where habitats of principal importance are identified during these pre-construction surveys, and there is potential for impacts on these habitats, the Applicant will prepare a Benthic Mitigation Plan, in consultation with stakeholders, as detailed in commitment ID BE05 in **Application Document 7.5.3.2 CEMP Appendix B Register of Environmental Actions and Commitments (REAC)**.

Significance of effect

2.9.20 Based on the medium or low sensitivity of benthic ecological receptors, the impact of temporary physical disturbance to benthic habitats and species, including habitats such as mussel beds and peat and clay exposures, has been assessed as having a small magnitude which results in a **minor effect**, which is not significant.

Temporary increase in SSC and sediment deposition leading to increased turbidity and smothering effects and possible contaminant mobilisation

2.9.21 Seabed disturbance from pre-installation and installation activities have the potential to increase SSC, creating a sediment plume in the water column that can travel away from the Offshore Scheme before the sediment is deposited on the seabed. There are several potential effects to benthic receptors associated with increased SSC and sediment deposition including:

- Reduced photosynthesis due to increased turbidity, resulting in reduced primary production in algae;
- Smothering of invertebrate species and clogging of respiratory and feeding apparatus; and
- Indirect effects of the release of contaminants, such as heavy metals and hydrocarbons, during sediment mobilisation, on benthic species.

2.9.22 SSC and depositional loads will vary along the Offshore Scheme depending on the local environmental conditions, particularly the sediment type and degree of water movement

(**Application Document 6.2.4.2 Part 4 Marine Chapter 2 Physical Environment**). The Offshore Scheme is characterised by six broadscale habitat complexes: Atlantic and Mediterranean moderate energy circalittoral rock; sublittoral coarse sediments; sublittoral sand; sublittoral mud; sublittoral mixed sediments; and sublittoral biogenic reef.

2.9.23 Modelling has been undertaken to estimate the extent of sediment dispersion before deposition as a result of cable installation activities. The installation activities modelled were ploughing and jetting. The method for these calculations, and the results, are reported in further detail in **Application Document 6.2.4.1 Part 4 Marine Chapter 1 Physical Environment** and **Application Document 6.3.4.1.A Suspended Sediment Modelling**. Based on this modelling, the highest dispersion is associated with jetting activities during cable installation. Therefore, effects from this activity have been assessed as a worst-case scenario.

2.9.24 The effects resulting from pre-sweeping/sand wave levelling are captured within the modelling results provided due to the comparable sediment loss rates which are within the levels of uncertainty associated with estimating these inputs.

Sensitivity

2.9.25 Habitat indicative of Annex I 'sandbanks which are slightly covered by sea water all the time', was observed within the Offshore Scheme, although is not specifically protected under any designated site. Margate and Long Sands SAC, 3.0 km west of the Offshore Scheme, is the nearest site designated for the protected of Annex I sandbanks (JNCC, 2017a). Sandbanks in shallow water are dynamic and are usually subject to varying levels of natural turbidity and energy. This natural disturbance regime means they generally support only a low level of biodiversity. Thus, the sensitivity of sandbanks to increased SSC and deposition is considered to be negligible.

2.9.26 Within the Offshore Scheme there were two additional NERC habitats of principal importance observed – 'communities on circalittoral rock' and 'subtidal sands and gravels'. These are not specifically protected by a designated site but are still considered to be of medium value. These habitats can support diverse epifaunal communities, with some species vulnerable to increased SSC. Thus, sensitivity is considered to be medium.

2.9.27 The Offshore Scheme also includes areas of subtidal muds. These habitats are widespread in this region of the North Sea and so are of low value. Subtidal muds support infaunal communities, as well as some mobile species including crustaceans and echinoderms which can move away from the effects. The infaunal communities that dominate these habitat types are generally tolerant of temporary elevated SSCs and deposition as an increase in suspended particulates and subsequent deposition of organic matter will increase food availability for deposit feeders that rely on a nutrient supply at the sediment surface (Tyler-Walters, De-Bastos, & Watson, 2023; De-Bastos & Watson, 2023). Moreover, studies have demonstrated that infauna are able to reestablish burrows following periods of increased sediment deposition (Maurer, et al., 1986) events. As a result, these subtidal mud habitats have a good capacity to quickly recover from effects associated with increased SSC and are considered of low sensitivity.

2.9.28 Moreover, the Offshore Scheme also includes areas of subtidal mixed sediment. These habitats are widespread in this region of the North Sea and so are of low value. Subtidal mixed sediment benthic habitats support infaunal communities, as well as some mobile species including crustaceans and echinoderms which can move away from the effects. As with subtidal mud habitats, infaunal communities are generally tolerant of the levels of SSC and sediment deposition anticipated to result from installations of the Offshore Scheme and therefore it is expected that they will have a good capacity to quickly recover. Mixed sediments also support epifaunal species and although increases in turbidity may impact feeding rates of filter feeders, studies have demonstrated the ability for species to be tolerant of short-term elevations in SSC (Essink, 1999). However, some sessile and epifaunal species associated with mixed sediments are understood to be sensitive to sediment deposition, with burial under 2 cm of sediment for longer than eight days leading to mortality (Hutchinson, Hendrick, Burrows, Wilson, & Last, 2016). Therefore, these mixed sediment habitats are considered of medium sensitivity.

2.9.29 Moreover, during the benthic surveys, beds of the filter feeding mussel, *M. edulis,* were identified within the Offshore Scheme Boundary. These mussel beds are listed as a Habitat of Principal Importance under Section 41 of the NERC Act (2006) and at KP109, the aggregations of this *M. edulis* were observed in continuous reef formations (**Application Document 6.3.4.2.D Appendix 4.2.D Interim Subtidal Survey Report (Additional Surveys)**), and therefore, are indicative Annex I habitat 'biogenic reefs' (H1170). However, this habitat is not specifically protected under any designated site in the survey corridor. *M. edulis* is often found in areas of high turbidity, with studies demonstrating a high tolerance to increased SSC (Essink, 1999). However, mussels are understood to have a medium sensitivity to sediment deposition as they are unable to emerge from sediments deeper than 2 cm (Last, Hendrick, Beveridge, & Davies, 2011; Essink, 1999). *S. spinulosa* was also observed within the Offshore Scheme Boundary, but reef formations were not identified (Gubbay, 2007). *S. spinulosa* can tolerate smothering and as tube growth is dependent on the presence of suspended particles, increased SSC could facilitate tube construction (Jackson & Hiscock, 2008). Therefore *S. spinulosa* are considered to have a low sensitivity.

2.9.30 The Offshore Scheme Boundary runs parallel to the Goodwin Sands MCZ for approximately 3.2 km, between KP107.3 to KP110.5, ensuring avoidance of the designated features of the site. However, as the MCZ is within the dispersion range of any increase in SSC, there is potential for the protected features to be impacted. Goodwin Sands MCZ is designated for the protection of several benthic habitat features, including sediments, rock and biogenic reef habitats (Table 2.15). Sediment features, such as the 'subtidal coarse sediment' and 'subtidal sand' features are usually subject to varying levels of turbidity and SSC (Riley & Ballerstedt, 2005). These habitats also support epifaunal species that have been observed to be tolerant of short-term elevations in SSC (Essink, 1999; Widdows, Bayne, Livingstone, Newell, & Donkin, 1979). Moreover, these habitats are not sensitive to sediment deposition (Tillin, Budd, Lloyd, & Watson, 2023; Tyler-Walters, Tillin, & Watson, 2024) with studies demonstrating that mobile polychaetes and amphipods are able to burrow through a sediment depths of up to 5 cm (Tillin, Garrard, Lloydd, & Watson, 2023). Moreover, although no longer within the Offshore Scheme Boundary, of the 2021 sample stations investigated in the MCZ, fauna was found to be sparse (S026 to S031, **Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)**). Thus, their sensitivity to increased SSC is considered to be low.

2.9.31 The habitats 'Moderate energy circalittoral rock', 'Ross worm *Sabellaria spinulosa* reefs', and 'Blue mussel *Mytilus edulis* beds' are able to support higher biodiversity, supporting stable communities, with some species vulnerable to increased SSC and the associated deposition of sediment. As previously discussed, sensitivity of mussel beds and *S. spinulosa* reef to increased SSC are considered to be medium and low, respectively.

2.9.32 Just outside the Offshore Scheme boundary are reef and submerged or partially submerged sea caves, habitats designated by the Thanet Coast SAC. Cave habitats are not sensitive to changes in SSC from cable installation (NE Designated Site pages) and this habitat is not considered further. For the intertidal and infralittoral reef, sensitivity to SSC ranges from not sensitive to medium sensitivity. Considering the location of these features, within an area of high natural variability in SSC due to wave and tidal water movement, sensitivity is considered to be low.

Magnitude of impact

2.9.33 The majority of the route (approximately 80%) is comprised of sublittoral sand and coarse sediments. Based on calculations of fall velocity, the maximum distance travelled by larger fractions of sands and gravels is expected to be approximately 20 m and will subsequently be re-deposited either directly back into the trench or within a few meters of the area of disturbance within timescales in the order of seconds to tens of seconds (**Application Document 6.2.4.1 Part 4 Marine Chapter 1 Physical Environment**), having a very localised effect. Fine sands, silts and clay may, however, be transported beyond the Offshore Scheme. Due to the higher release rate (the rate at which disturbed sediment is introduced into the water column during the installation process) and lower level of dispersion associated with fine sands, SSC values are typically higher than those associated with mud. Therefore, the dispersion of fine sands is considered as the worst-case scenario within this assessment.

2.9.34 The sediment dispersion modelling showed that SSC levels generally remained below 300 mg/l, with the higher concentration only occurring as a short-term spike in the first 24 hours of disturbance. From the point of mobilisation, dispersion processes will act to dilute the concentration of fine sand. Concentration increases of up to 100 mg/l were found to be limited to a dispersal range of 11 km, but these distances were associated with the resuspension of sediment at multiple locations, due to tidal currents, rather than a single large plume. It is considered that there will be no significant elevated SSC beyond this distance as these sediment fractions will be rapidly diluted, returning to background levels within 14 km from the point of mobilisation (**Application Document 6.2.4.1 Part 4 Marine Chapter 1 Physical Environment**). Studies have demonstrated that a long-term increase in concentrations above 250 mg/l can impair the growth of filter-feeding organisms (Essink, 1999; Widdows, Bayne, Livingstone, Newell, & Donkin, 1979). However, as any increase in suspended sediments at this concentration will be highly temporary, reducing significantly from the time of mobilisation, and as installation activities will move along the Offshore Scheme, any measurable change in SSC will be temporary, short-term and localised to the point of mobilisation. Moreover, following the initial 24-hour period after any disturbance, the predicted increased SSC associated with the Proposed Project is of a magnitude that is not considered to lead to adverse effects in benthic habitats and species. Therefore, the magnitude is considered to be small.

2.9.35 Gravel and sand represent the dominant sediment types which were recorded along the cable route. Based on the known settling distance of these sediments, coarse sediments will be deposited rapidly, within the immediate vicinity (within 20 m) of the Offshore Scheme. Finer fractions may be carried in suspension beyond this distance, settling on the seabed within 14 days. Based on calculations undertaken in **Application Document 6.2.4.1 Part 4 Marine Chapter 1 Physical Environment**, fine sand will settle within a maximum distance of 17 km. However, this deposition will be limited to a thickness of less than 0.5 mm on the seabed, which is considered very small and equivalent to natural variability. Due to this small magnitude of the deposition thickness, any accumulation of sediment on the seabed is unlikely to be detectable in the field and the associated deposition on the seabed is not expected to lead to any adverse effect to any benthic features. The potential risk of smothering of sensitive benthic habitats is therefore considered to be negligible.

2.9.36 Moreover, studies demonstrate that filter feeders, such as blue mussels, are able to withstand temporary periods of sediment deposition at thicknesses up to 2 cm (Last, Hendrick, Beveridge, & Davies, 2011), significantly greater than deposition associated with the Proposed Project. Therefore, the potential risk of smothering of benthic habitats and species from installation activities is considered unlikely and the magnitude of the effect is predicted to be negligible.

2.9.37 Sediment contaminants could also be mobilised when from pre-installation and installation activities. Contaminant concentrations were found to vary throughout the route, but at levels consistent with general background levels for this region of the North Sea. Therefore, increased SSC and deposition is not anticipated to result in detectable changes in sediment bound contaminants above background levels. Therefore, the overall magnitude of the impact is considered to be negligible.

Significance of effect

2.9.38 Based on the low-medium sensitivity of benthic ecological receptors, the impact of temporary increase in SSC and sediment deposition has been assessed as having a small magnitude which results in a **minor effect**, which is considered to be not significant.

Changes to marine water quality during cable installation and cable lay from the use of drilling fluids

2.9.39 The Offshore Scheme will use a trenchless solution, such as HDD, at both landfall locations. At the Suffolk landfall in Suffolk, the entry/exit points will be entirely in the subtidal environment. At the Kent landfall, the entry/exit points will be located within an area of intertidal mudflat the intertidal range.

2.9.40 The use of HDD as a trenchless solution and therefore the discharge of drilling fluids at the breakout location has the potential to alter marine water quality and negatively affect benthic receptors in the surrounding habitat at landfall locations.

Sensitivity

2.9.41 The HDD entry/exit points, at the Suffolk Landfall, are located within a shallow region of sublittoral mud habitat (**Figure 6.2.4.3.4 Habitats Present at, and Location of, Trenchless Solution Entry/Exit Points** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**) Sublittoral muds are likely to support infaunal communities that will not have high sensitivity to the drilling mud that may settle temporarily on the seabed. There are also areas of circalittoral rock in the vicinity of the HDD entry/exit points that support epifaunal species that may have higher sensitivity to increase sediment load but considering the generally dynamic nature of the shallow coastal waters, and the presence of fine sediment habitats, there is likely to be natural resuspension distribution of sediments occurring due to tides and wave action. Therefore, the sensitivity of any receptors likely to be in the vicinity of any HDD fluid release is considered to be low.

2.9.42 The HDD entry/exit points at the Kent Landfall are located within an area of intertidal mud (**Figure 6.2.4.3.4 Habitats Present at, and Location of, Trenchless Solution Entry/Exit Points** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). Intertidal mudflat is listed as a Habitat of Principal Importance under Section 41 of the NERC Act (2006), and infaunal species associated with this habitat will not have high sensitivity to the drilling mud that may settle temporarily on the seabed. The presence of mudflat suggests that the bay is sheltered from wave action, however, considering the regular tidal movement in the intertidal zone, the sensitivity of any receptors likely to be in the vicinity of any HDD fluid release is considered to be low.

Magnitude of impact

2.9.43 Small amounts of fluid likely to be released, it is anticipated that only a temporary local reduction in water quality at the HDD breakout may occur. Therefore, only receptors in the immediate vicinity of the HDD breakouts have the potential to be in contact with drilling fluids if a leak or spill occurs.

2.9.44 At the Suffolk landfall, it has been estimated that up to 7,240 m^3 of drilling fluid will be discharged. Some particulates from the drilling muds may settle, but the presence of fine sediment habitats at the HDD entry/exit points coupled with the generally dynamic nature of shallow coastal waters, there is likely to be natural resuspension distribution of sediments occurring due to tides and wave action.

2.9.45 At the Kent landfall, it has been estimated that up to 40 m^3 of drilling fluid will be discharged. The presence of intertidal mudflat at the HDD entry/exit points indicate that the landfall location is comparatively more sheltered from wave action. Although the potential dispersion of suspended particles is considered to be a maximum of 17 km (**Application Document 6.2.4.1 Part 4 Marine Chapter 1 Physical Environment**), the volume of HDD drilling fluid will be very limited and the regular tidal movement in the intertidal zone acting to disperse and dilute any drilling fluid released.

2.9.46 Additionally, drilling fluid discharges from the Proposed Project HDD operations will be single events over a short period of time. All drilling fluids used, such as bentonite, will be selected from the OSPAR List of Substances/Preparations Used and Discharged Offshore (2021) which are considered to ‘Pose Little or No Risk to the Environment’ (PLONOR). Additionally, where entry/exit points are in the intertidal area (i.e. at the southern landfall) drilling fluid will be captured where possible (control measure LVS05 in **Application Document 7.5.3.1 CEMP Appendix A Outline Code of Construction Practice**, Section 2.8). Therefore, the magnitude of any changes to marine water quality from the use of drilling fluids is considered to be small.

Significance of effect

2.9.47 Based on the low-medium sensitivity of benthic ecological receptors, the impact of changes to marine water quality during cable installation and cable lay from the use of drilling fluids has been assessed as having a small magnitude which results in a **minor effect**, which is not significant.

Underwater sound impacts on marine invertebrates

2.9.48 There are several activities associated with the construction of the Offshore Scheme that generate underwater sound. The sources of underwater sound include geophysical surveys, UXO clearance, route preparation, cable installation and project related vessel movements.

Sensitivity

2.9.49 Sensitivity to the impact of underwater sound on benthic ecology, depends on the sensitivity of the species associated with the habitats. Marine invertebrates are believed to be sensitive to particle motion rather than to sound pressure (Popper & Hawkins, 2018), although few formal studies have been conducted on the impacts of underwater sound. At present there are no published sensitivity thresholds for invertebrates and observed responses are generally in relation to higher intensity sound sources such as from seismic surveys.

2.9.50 However, the effects of underwater sound on some invertebrates have been reported in the literature. For example, anatomical damage was observed in rock lobster up to a year following seismic surveys (which usually generate very high intensity sound), but no effects were observed on snow crabs (Carrol, Przeslawski, Duncan, Grunning, & Bruce, 2017). Furthermore, the crustacean, *Nephrops norvegicus*, and the bivalve, *Ruditapes philip pinarum*, demonstrated behavioural responses to impact pile driving sound source levels in a controlled laboratory environment, including physiological stress responses (Solan, et al., 2016). However, some species tested in this study, such as the brittlestar, *Amphiura filiformis,* demonstrated no behavioural response to underwater sound.

2.9.51 In other laboratory experiments, a stress response in green shore crab, *Carcinus maenas*, subject to ship playback sound was observed (Wale, Simpson, & Radford, 2013), although, repeated exposure resulted in the crabs' habituation or tolerance to it. Moreover, responses can be subtle and may take extended periods of time to be expressed across a population or become detectable at an ecosystem level. In the absence of suitable anatomical studies, mortality may be a useful indicator of impacts to marine invertebrates. However, field-based studies revealed no evidence of increased mortality in scallops, clams, or lobsters following air gun exposure, or of reduced catch-rates for plankton, reef associated invertebrates, snow crab, shrimp, or lobster (Sole, et al., 2023).

2.9.52 In conclusion, studies have found a range of responses in invertebrates, depending on species, with little evidence of increased mortality or ecosystem impacts. Although there was evidence of anatomical damage and behavioural responses in lab studies with specific species (e.g., rock lobster (Carrol, Przeslawski, Duncan, Grunning, & Bruce, 2017) and green shore crab (Wale, Simpson, & Radford, 2013), respectively) there was also evidence that habituation is possible. Thus, the overall sensitivity of benthic ecological receptors to underwater noise is considered to be negligible.

Magnitude of impact

2.9.53 The sound associated with all construction activities is of an intensity significantly lower than that for seismic and piling sound sources, where some effects have been detected. Mobile species are able to move away and since the sound generating activities are boat based, they are constantly moving, limiting the exposure duration of any benthic species that are unable to move away. Therefore, underwater sound generated by the Proposed Project activities is considered to have a negligible magnitude.

Significance of effect

2.9.54 Based on the negligible sensitivity of benthic ecological receptors, the effect of underwater sound on invertebrates has been assessed as having a negligible magnitude which results in a **negligible effect**, which is not significant.

Operation and Maintenance Phase

Direct loss of benthic habitats and species due to placement of hard substrates on the seabed

2.9.55 Cable installation, and repair, may require protection measures, in the form of rock berms, rock backfill or concrete mattresses, at some locations where the minimum target depth of lowering of 0.5 m below the seabed cannot be achieved. Introduction of hard substrate would replace other natural substrates, leading to permanent loss of these habitats and associated species. The total estimated area of permanent loss of habitat of 0.18 km^2 (Table 2.17).

Sensitivity

2.9.56 At the Suffolk Landfall, the entry/exit points will be entirely in the subtidal environment within a mud habitat (**Figure 6.4.4.2.4 Habitats present at, and Location of, Trenchless Solution Entry/Exit points** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). This mud-based habitat is likely to support diverse infaunal communities. Activities requiring the placement of cable protection in these areas will result in habitat loss, and some faunal mortality, but where there are mobile infauna in the sediments beneath the cable protection, some animals may be able to redistribute to surrounding sediments. Geophysical data indicate the potential presence of patches of soft rock that are more likely to support epifaunal species. Epifaunal species are likely to show a level of mortality as they are unable to move away from material added on top of the seabed. Thus, the habitats are therefore, considered to have a potential high sensitivity to direct loss.

2.9.57 At the Kent Landfall, the entry/exit points will be located within the intertidal range, located within an area of intertidal mud (**Figure 6.4.4.2.4 Habitats Present at, and Location of, Trenchless Solution Entry/Exit Points** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). Intertidal mudflat is listed as a Habitat of Principal Importance under Section 41 of the NERC Act (2006). However, where permanent protection of the duct ends is required, this will be buried to a minimum of 0.5 m below seabed level. Therefore, there will be no cable protection installed on the seabed that could result in permanent habitat loss within the intertidal area of Pegwell Bay as detailed in **Application Document 9.13 Pegwell Bay Construction Activities Technical Note**, submitted at Deadline 1. This habitat type is not, therefore, considered further.

2.9.58 Rock placement has been identified as required at several locations along the route. As the locations of rock berms are to be established as per monitoring surveys, as a worst-case scenario, the sensitivity of all habitats present along the Offshore Scheme have been considered. This will include all six of the habitat complexes: Atlantic and Mediterranean moderate energy circalittoral rock; sublittoral coarse sediments; sublittoral sand; sublittoral mud; sublittoral mixed sediments; and sublittoral biogenic reef.

2.9.59 Habitat indicative of Annex I ‘sandbanks which are slightly covered by sea water all the time’, was observed within the Offshore Scheme, although is not specifically protected under any designated site. Margate and Long Sands SAC, 3.0 km west of the Offshore Scheme, is the nearest site designated for the protected of Annex I sandbanks (JNCC, 2017a). A detailed routing and siting study was undertaken to ensure the complete avoidance of the Annex I habitat features within Margate and Long Sands SAC (**Application Document 8.1 Historic Report 1 (CPRSS)**. Moreover, according to Admiralty charts, the Offshore Scheme avoids the any major sandbanks in the Thames Estuary (**Figure 6.4.4.2.6 Location of the Offshore Scheme in relation to Admiralty chart of the Thames Estuary** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). Therefore, rock placement is not being considered in any areas of designated Annex I habitat.

2.9.60 Within the Offshore Scheme there were two additional NERC habitats of principal importance observed – ‘communities on circalittoral rock’ and ‘subtidal sands and gravels’. These are not specifically protected by a designated site but are still considered to be of medium value; these habitats can support high diversity, stable communities that are likely to be more vulnerable to loss of habitat. For many infaunal species, the introduction of cable protection results in the direct loss of the surface of the habitat, but some fauna within the sediments below, may be able to redistribute to other areas. Also, where rock berms provide cable protection the addition of material to the surface is not expected to result in a significant decline in oxygenation in the sediments below, as the new material can still facilitate water movement. Thus, significant levels of mortality to infaunal communities is not expected and sensitivity of habitats supporting purely infaunal communities are considered to have medium sensitivity to seabed surface habitat loss. However, epifaunal species are likely to show a level of mortality as they are unable to move away from material added on top. Thus, where habitats support highly diverse epifaunal communities they are therefore, considered to have high sensitivity to direct loss.

2.9.61 Moreover, during the benthic surveys, beds of the filter feeding mussel, *M. edulis,* were identified, but only at a single location, within the Offshore Scheme Boundary. These mussel beds are listed as a Habitat of Principal Importance under Section 41 of the NERC Act (2006) but were not categorised as an Annex 1 habitat (**Application Document 6.3.4.2.D Appendix 4.2.D Interim Subtidal Survey Report (Additional Surveys).** Additionally, this habitat is not specifically protected under any designated site in the survey corridor. *M. edulis* are attached to the seabed, making them vulnerable to direct loss (Tyler-Walters, Mytilus edulis Common mussel. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, 2008). *S. spinulosa* was also observed within the Offshore Scheme Boundary, but similarly reef formations were not identified (Gubbay, 2007). Although recruitment of this species is rapid (within a year) (Wilson, 1929), the species is fixed to the substratum and so direct habitat loss will cause mortality, thus this species has a high sensitivity to this impact pathway (Jackson & Hiscock, 2008).

2.9.62 The Offshore Scheme Boundary runs parallel to the Goodwin Sands MCZ for approximately 3.2 km from approximately KP107.3 to KP110.5, ensuring avoidance of the designated features of the site. Therefore, no direct loss of habitats is anticipated within Goodwin Sands MCZ.

2.9.63 The remaining habitats within the Offshore Scheme comprise subtidal muds and mixed sediments, which are widespread in this region of the North Sea and so are of low value, but support a range of different communities and so are considered to have medium sensitivity (mud) to high sensitivity (mixed) to direct loss.

Magnitude of impact

2.9.64 The total footprint of permanent habitat loss as a result of placement of cable protection, including remedial rock berms, rock backfill, and concrete mattresses is approximately 0.18 km^2, including 0.00036 km^2 across the Suffolk Landfall.

2.9.65 The placement of concrete mattresses at the HDD entry/exits of the Suffolk Landfall will lead to the direct loss of 0.00036 km^2 of subtidal mud (**Figure 6.4.4.2.4 Habitats Present at, and Location of, Trenchless Solution Entry/Exit Points** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). The area of loss is very limited, with subtidal muds understood to be extensive throughout the wider North Sea, and as such the direct loss of this habitat is predicted to be of small magnitude.

2.9.66 Remedial rock berms are to be established where natural back fill has not been sufficiently rapid for the section of route. Although the location of the rock berms is currently unknown, a worst-case scenario has been estimated, suggesting that rock berms may be required over a length of 12 km (9.84% of the Offshore Scheme) (Table 2.17). The extent of remedial rock berms is limited, and thus the direct loss associated with this activity is predicted to be of small magnitude.

2.9.67 Rock backfill will be carried out along approximately 38 km of the route, between KP35.0 to KP58.0 and KP 81.5 to KP 96.5 (totalling 31.15% of the Offshore Scheme) (Table 2.17). The habitat type most commonly identified as requiring rock backfill was sublittoral coarse sediment (**Figure 6.4.4.2.3 Marine Cable Crossings and Areas of Rock Backfill within the Offshore Scheme Boundary** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). Additionally, cable protection will be required at ten in-service cable crossings (**Figure 6.2.4.3.3 Marine cable crossings and areas of rock backfill within the Offshore Scheme Boundary** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**), leading to a loss of 0.05 km^2 of subtidal biotopes such as biogenic reef, mixed sediments, coarse sediments and sand (Table 2.17; Table 2.18).

2.9.68 Biotopes of biogenic reef of *S. spinulosa* and *M. edulis*, were identified in the Offshore Scheme (**Figure 6.4.4.2.2 Subtidal Habitat Complexes and Annex I Habitats Identified within the Offshore Scheme Boundary** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). The aggregations of *S. spinulosa* were only observed in patches and thus were unable to be classified as reef formations (Gubbay, 2007; OSPAR, 2010). There is one cable crossing located in an area classified as sublittoral biogenic reef, Farland (North), that will lead to a loss of 0.005 km^2 of habitat at KP8.4. This crossing is located in a habitat of '*Sabellaria spinulosa* on stable circalittoral mixed sediment' (A5.611), however reef formations of *S. spinulosa* were not identified at this location (Gubbay, 2007) (Table 2.18; **Figure 6.4.4.2.3 Marine Cable Crossings and Areas of Rock Backfill within the Offshore Scheme Boundary** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). Mussel bed, categorised as an Annex I habitat, was observed only at one location, KP109 and is not specifically protected by any designated site. Direct impacts to protected habitats, including mussel beds, have been specifically avoided by careful routing around Goodwin Sands. Thus, the area of loss of biogenic reef in the Offshore Scheme will be very limited and outside any protected site. The Applicant will be required to complete pre-construction surveys to inform final cable route design and installation. Where habitats of principal importance are identified during these pre-construction surveys, and there is potential for impacts on these habitats, the Applicant will prepare a Benthic Mitigation Plan, in consultation with stakeholders, as detailed in commitment ID BE05 in **Application**

Document 7.5.3.2 CEMP Appendix B Register of Environmental Actions and Commitments (REAC).

2.9.69 Rock protection at each cable crossing will total an area of 0.005 km^2. This will lead to a loss of 0.025 km^2, 0.01 km^2, and 0.01 km^2 of sublittoral sands, sublittoral coarse sediment, and sublittoral mixed sediment, respectively (Table 2.18; **Figure 6.4.4.2.3 Marine Cable Crossings and Areas of Rock Backfill within the Offshore Scheme Boundary** in **Application Document 6.4.4.2 ES Figures Marine Benthic Ecology**). Given the prevalence of these sediment habitats within the wider North Sea area, the dominance of these habitats across the Offshore Scheme, and the small spatial scale of permanent losses, this effect would not be expected to compromise the functional integrity of general habitats and species or diminish biodiversity at the regional scale. Therefore, any loss would be highly localised and small in scale, limited to isolated areas, and thus the magnitude is considered to be small. Also, the Proposed Project has sought to avoid, where possible, crossing cables in sensitive locations to avoid or minimise interactions with sensitive habitats. Where possible, the rock protection used for cable crossings will be locally sourced or environmentally benign (control measure BE04 in **Application Document 7.5.3.1 Appendix A Outline Code of Construction Practice**, Section 2.8).

Significance of effect

2.9.70 Although habitats of a low-high sensitivity are present within sections requiring external cable protection, the impact of direct loss of subtidal benthic habitats and species has been assessed as having a small magnitude which results in a **minor effect**, which is not significant.

Table 2.18 Locations of cable crossing requiring cable protection and corresponding biotopes

Cable crossing	Owner	Type	KP	Habitat complex	Biotope complex
Farland (North)	BT	FO Cable	8.4	Sublittoral biogenic reefs	*Sabellaria spinulosa* on stable circalittoral mixed sediment
EA1 N	Scottish Power Renewables	Power	13.4	Sublittoral mixed sediments	Circalittoral mixed sediments
EA1 S	Scottish Power Renewables	Power	13.8	Sublittoral mixed sediments	Circalittoral mixed sediments
Britned	BritNed	Power	87.3	Sublittoral sand	Circalittoral muddy sand
Mercator	BT	FO Cable	90.7	Sublittoral sand	Circalittoral muddy sand

Cable crossing	Owner	Type	KP	Habitat complex	Biotope complex
PEC	Lumen	FO Cable	104.6	Sublittoral coarse sediments	*Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles/ Circalittoral mixed sediments
Tangerine	Lumen	FO Cable	106.7	Sublittoral sand	*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand
Thanet North	Balfour Beatty	Power	107.6	Sublittoral sand	*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand
Thanet South	Balfour Beatty	Power	107.6	Sublittoral sand	*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand
Nemo Offshore	Nemo Link	Power	113.1	Sublittoral coarse sediments	*Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles

Introduction and spread of INNS via the addition of cable protection

2.9.71 The installed cable is expected to require protection at some locations, which will introduce hard substrates in the form of rock protection or mattresses, in habitats dominated by sediments ranging from mud to sand and gravel. This could provide additional habitat for any existing epifaunal INNS populations allowing for localised spreading.

2.9.72 The potential impact of the introduction of INNS via vessel hull or ballast water was considered unlikely and scoped out due to the implementation of control and management measures (Section 2.3).

2.9.73 Sensitivity to the impact of INNS varies between habitats and the vulnerability of individual species associated with them. Whilst most non-native species are unlikely to become invasive, those that do can out-compete native species and introduce diseases which could result in significant changes to community composition and mortality.

Sensitivity

2.9.74 The Offshore Scheme is characterised by six broadscale habitat complexes. Within these some habitats of conservation importance have been identified.

2.9.75 Habitat indicative of ‘sandbanks which are slightly covered by sea water all the time’, was observed within the Offshore Scheme, although is not specifically protected under any designated site. Margate and Long Sands SAC is 3.0 km west of the Offshore Scheme and is the nearest site designated for the protection of Annex I sandbanks (JNCC, 2017a). Sandbanks in shallow water are subject to significant wave and tidal energy, are often low in biodiversity and so are considered to have high capacity to tolerate disturbance. This habitat is therefore, considered to have a low sensitivity to the introduction and spread of INNS.

2.9.76 Within the Offshore Scheme there two additional NERC habitats of principal importance – ‘communities on circalittoral rock’ and ‘subtidal sands and gravels’. These are not specifically protected by a designated site but are still considered to be of medium value. Furthermore, the remaining habitats within the Offshore Scheme comprise subtidal muds and mixed sediments, which are widespread in this region of the North Sea and so are considered to be of low value. These habitats can support high diversity, stable communities. Individual species associated with these habitats have the potential to be vulnerable to competition from INNS, allowing INNS to spread throughout the habitat. However, there are limited records of INNS colonisation of these habitats, and in general colonisation of subtidal habitats is low (OSPAR Commission, 2023).These habitats are therefore, considered to have medium sensitivity to the introduction and spread of INNS.

2.9.77 Moreover, during the benthic surveys, *M. edulis* beds were identified within the Offshore Scheme Boundary. These mussel beds are listed as a Habitat of Principal Importance under Section 41 of the NERC Act (2006) and at KP109, the aggregations of this *M. edulis* were observed in continuous reef formations (**Application Document 6.3.4.2.D Appendix 4.2.D Interim Subtidal Survey Report (Additional Surveys)**), and therefore, are indicative of Annex I habitat ‘biogenic reefs’ (H1170). However, this habitat is not specifically protected under any designated site. *S. spinulosa* was also observed within the Offshore Scheme Boundary, but similarly reef formations were not identified (Gubbay, 2007). These habitats are able to support higher biodiversity, supporting stable communities, with some species that may be vulnerable to INNS. However, there are limited records of INNS colonisation of these habitats, and in general colonisation of subtidal habitats is low (OSPAR Commission, 2023). Therefore, sensitivity of these habitats is considered to be medium.

2.9.78 The Offshore Scheme Boundary running directly adjacent to the boundary of Goodwin Sands MCZ for approximately 3.2 km , ensuring avoidance of the designated features of the site. However, Goodwin Sands MCZ is designated for the protection of the several benthic habitat features (Table 2.15) which have the potential to be sensitive to INNS. Although not within the Offshore Scheme Boundary, of the sample stations completed within the MCZ, fauna was found to be sparse (S026 to S031, **Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)**). Sediment features, such as the ‘subtidal coarse sediment’ and ‘subtidal sand’ features are often low in biodiversity, and so are considered to have a low sensitivity to the introduction and spread of INNS. ‘Moderate energy circalittoral rock’, ‘Ross worm *Sabellaria spinulosa* reefs’, and ‘Blue mussel *Mytilus edulis* beds’ habitats within the MCZ are able to support higher biodiversity, supporting stable communities, with some species that may be vulnerable to INNS. However, there are limited records of INNS colonisation of these habitats, and in general colonisation of subtidal habitats is low (OSPAR Commission, 2023). Therefore, sensitivity of these habitats is considered to be medium.

2.9.79 Overall, the sensitivity of subtidal benthic ecology to the introduction and spread of INNS is considered to be low to medium.

2.9.80 The only activities occurring within the intertidal area are located at the Kent Landfall. This landfall is located in an area of intertidal mudflats. Although shorelines comprised of mainly mud have been seen to be less suitable for the settlement of INNS when compared with rockier shores (Spencer, Edwards, Kaiser, & Richardson, 1994), the introduction of artificial substrata can provide additional habitat and enable INNS to spread (Tillin, Kessel, Sewell, Wood, & Bishop, 2020), and there is a higher risk of INNS colonisation in intertidal habitats (OSPAR Commission, 2023). Although the proliferation of INNS can lead to the alteration of the biotope as INNS out complete native species, post-construction there will be limited hard structures present within the intertidal, limiting areas of possible colonisation by INNS. Therefore, the sensitivity of intertidal benthic ecology to the introduction and spread of INNS is considered to be medium.

Magnitude of impact

2.9.81 Rock berms, rock backfill, and concrete mattresses are proposed for several locations along the Offshore Scheme to protect the cable at intersections with other cables or pipeline infrastructure and in areas where burial cannot be achieved. The protection measures in these locations are anticipated to cover a total area of 0.18 km^2.

2.9.82 Some studies have demonstrated the ability for artificial hard structures to function as artificial rocky reef, which are known to be preferred habitat for many INNS acting as ‘ecological stepping stones’ (Adams, Miller, Aleynik, & Burrows, 2014). This may facilitate the colonisation and spread of INNS in areas of the benthos which may have previously been unsuitable. However, there remain uncertainties surrounding this theory (Coolen, et al., 2020) and the function of artificial structures as ‘stepping stones’ remains unclear.

2.9.83 Infrastructure associated with cable routes, including cable protection, are usually restricted to a narrow strip along parts of the cable route. Although, there are concerns around introduced substrata providing habitat for INNS, particularly given the substantial growth of marine infrastructure in the North Sea, the available field studies of cables indicate a colonisation of the provided new habitat by endemic, rather than invasive fauna (OSPAR Commission, 2023). However, several studies indicate that the risk of the establishment of non-native species on hard substrates in subtidal areas exists, but is lower compared to structures in the upper part of the water column and in the intertidal zone (Kuhnz, Buck, Lovera, Whaling, & Barry, 2015; Sherwood, et al., 2016). Therefore, as subsea cables, and associated protection structures, are almost exclusively laid in the subtidal which makes them less prone to colonisation by non-native species (OSPAR Commission, 2023), and to date, no spread of INNS caused by submarine cabling has been documented (Taormina, et al., 2018) it is considered unlikely that INNS will be introduced to the subtidal environment during the placement of cable protection associated with the offshore scheme.

2.9.84 Furthermore, two INNS were recorded within the Offshore Scheme Boundary (**Application Document 6.3.4.2.A Appendix 4.2.A Benthic Characterisation Report (Original Report)**); Section 2.7). The acorn barnacle was found at two sample stations, and the slipper limpet at four. Both of these species already have a very well-established and long standing presence along the coasts of England (O'Riordan, Culloty, McAllen, & Gallagher, 2020; Blanchard, 1997) and no spread of invasive species directly caused by subsea cables has been documented (Taormina, et al., 2018; Hutchison, et al., 2020).

2.9.85 The only activities occurring within the intertidal area are located at the Kent Landfall. At this landfall, concrete mattresses will be used at HDD entry/exit points over an area of 0.00036 km^2. However, post-construction these will be buried and thus there will be limited hard structures present within the intertidal, limiting areas of possible colonisation by INNS. Additionally, to ensure that the potential impact of INNS introduction is reduced, all rock and concrete mattresses used for cable protection will be clean and from a suitable source (control measure BE03 in **Application Document 7.5.3.1 Appendix A Outline Code of Construction Practice**, Section 2.8). Moreover, an INNS Management Plan and Marine Biosecurity Plan will be produced to provide a framework for preventing the introduction and spread of INNS associated with the Proposed Project (control measure BE01 in **Application Document 7.5.3.1 Appendix A Outline Code of Construction Practice**, Section 2.8; **Application Document 7.5.12 Outline Offshore Invasive Non Native Species Management Plan; Application Document 7.7 Marine Biosecurity Plan**). Therefore, the overall magnitude of the impact is considered to be small.

Significance of effect

2.9.86 Based on the low-medium sensitivity of benthic ecological receptors, the impact of introduction and spread of INNS has been assessed as having a small magnitude which results in a **minor effect**, which is not significant.

Effects from thermal emissions

2.9.87 Submarine power cables are known to produce heat during operation which when buried in the seabed, can increase the temperature of surrounding sediment (Emeana, et al., 2016). Such heat has the potential to cause sediment dwelling and demersal mobile organisms to move away from the affected area. Increased heat may also alter physio-chemical conditions for epifaunal species and bacterial activity (with shifts in bacterial community composition and changes in nitrogen cycling) in surrounding sediments, contributing to altered faunal composition and localised ecological shifts (Meissner, Schabelon, Bellebaum, & Sordyl, 2006; Hicks, et al., 2018).

2.9.88 The full effect of temperature changes on sediment composition and related biogeochemical cycling are unknown. However, preliminary studies which have been conducted have indicated that increased temperatures could cause shifts in the community composition of bacteria, with corresponding changes in NH_4 concentrations and nitrogen cycling also occurring (Hicks, et al., 2018).

2.9.89 Sensitivity to the thermal emissions depends on the sensitivity of the species associated with benthic habitats. Sediment particle size composition has been identified as an influence on heat transfer in sediments (Emeana, et al., 2016), with coarser sediments found to experience the greatest temperature change but only to a short distance from the heat source. This compares to fine and coarse sands which experienced a lower temperature change but at a greater distance from the heat source. The Offshore Scheme comprises mainly coarse sediment and sand with varying smaller areas of mixed sediment and mud, and therefore the influence of thermal emissions is expected to vary but be limited overall.

Sensitivity

2.9.90 Habitat indicative of Annex I 'sandbanks which are slightly covered by sea water all the time', was observed in the Offshore Scheme. However, it is not specifically protected under any designated site. Margate and Long Sands SAC, 3.0 km west of the Offshore Scheme, is the nearest site designated for the protected of Annex I sandbanks (JNCC, 2017a). Sandbanks are often low in biodiversity as they are often subject to significant wave and tidal energy. Furthermore, sediment particle size composition has been found to influence heat transfer, with sandy habitats experiencing a smaller temperature change than finer sediments (Emeana, et al., The thermal regime around buried submarine high-voltage cables, 2016). Thus, this habitat is considered to have a low vulnerability and low sensitivity to thermal emissions.

2.9.91 Within the Offshore Scheme there are two additional NERC habitats of principal importance – 'communities on circalittoral rock' and 'subtidal sands and gravels'. These are not specifically protected by a designated site but are still considered to be of medium importance. These habitats support a range of benthic organisms, including infaunal species that may be directly affected by increases in sediment temperature. Coarser sediments may have higher biodiversity but with greater porosity will experience a lower temperature change than sandy habitats (Emeana, et al., The thermal regime around buried submarine high-voltage cables, 2016). Thus, the potential sensitivity of these habitats is also considered low.

2.9.92 Moreover, during the benthic surveys, *M. edulis* beds were identified within the Offshore Scheme Boundary. These mussel beds are listed as a Habitat of Principal Importance under Section 41 of the NERC Act (2006) and at KP109, the aggregations of this *M. edulis* were observed in continuous reef formations (**Application Document 6.3.4.2.D Appendix 4.2.D Additional Subtidal Survey Report (Additional Surveys)**), and therefore, are indicative of Annex I habitat 'biogenic reefs' (H1170). However, this habitat is not specifically protected under any designated site. *M. edulis* are found in a wide range of temperatures, and thus have a high tolerance to temperature changes, with studies indicating that increased temperatures has limited impacts on the physiology of *M edulis* (Tyler-Walters, Mytilus edulis Common mussel. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, 2008). *S. spinulosa* was also observed within the Offshore Scheme Boundary, but similarly reef formations were not identified (Gubbay, 2007). There are few studies that investigate the impact of increased temperature on *S spinulosa*, however, this species is also understood to be able to withstand temperatures changes (Jackson & Hiscock, 2008).Therefore, sensitivity of these habitats is considered to be low.

2.9.93 The Offshore Scheme Boundary runs directly adjacent to the Goodwin Sands MCZ for approximately 3.2 km from KP107.3 to KP110.5, ensuring avoidance of the designated features of the site. Therefore, due to the localised nature of any disturbance associated with thermal effects, it is not anticipated that there will be any impact of the Goodwin Sands MCZ.

Magnitude of impact

2.9.94 Increased sediment temperature has the potential to affect infaunal species and assemblages directly. Whilst the sediment surrounding the cable may be heated, there is negligible capability to heat the overlying water column because of the very high heat capacity of water, meaning there would be no effects on epibenthic communities.

2.9.95 The Offshore Scheme is expected to use one bundled cable which will be buried to a target burial depth between 1 m – 2 .5m below the seabed (as per control measure FSF01 in **Application Document 7.5.3.1 Appendix A Outline Code of Construction Practice**, Section 2.8). Heat dissipation modelling undertaken for a similar cable installation project, the Eastern Green Link 2 submarine HVDC transmission link between Peterhead in Aberdeenshire and Drax in North Yorkshire (AECOM, 2022) for bundled cables buried at a depth of 1.5 m, indicated that within 500 mm of the seabed surface the increase in sediment temperature was limited to approximately 3°C. However, seawater at the seabed surface will have a cooling effect and will dissipate any temperature increases further.

2.9.96 Although thermal effects would be long-term and occurring continuously for the operational lifetime of the Offshore Scheme, the temperature increase is low level and likely to be only a few degrees higher than ambient at the shallow sediment depths (<20 cm) at which infauna species are typically found. The latest OSPAR report states a threshold of 2°C temperature increase at a sediment depth of 0.2 m will only be exceeded in rare cases and for short periods of time (OSPAR Commission, 2023). Thus, if the burial depth is increased a to a target burial depth of target 1 m, then any further changes to temperature are also considered to be negligible. Additionally, due to natural seasonal changes in water temperature, a temperature change of a few degrees higher than ambient is regarded as an insignificant temperature increase.

2.9.97 A range of biotopes have been identified within the Offshore Scheme. Increased sediment temperature has the potential to affect infauna species and assemblages directly. However, the area affected is very limited and mobile fauna can move away. Whilst the sediment surrounding the cable may be heated there is negligible capability to heat the overlying water column because of the high heat capacity of water, meaning there would be no effects on epibenthic communities and impacts on benthic ecology are considered. Additionally, if any habitats of conservation concern are identified in pre-installation surveys, the Proposed Project will micro-route the cable to avoid or minimise interactions. Therefore, the overall magnitude of impact on benthic ecology is considered to be negligible.

Significance of effect

2.9.98 Based on the low sensitivity of benthic ecological receptors, the impact of disturbance from thermal effects has been assessed as having a negligible magnitude which results in a **negligible effect**, which is not significant.

Effects from EMF emissions

2.9.99 Subsea cables options associated with the Proposed Project are known to produce EMF emissions (Hutchison, Gill, Sigray, He, & King, 2020). EMF has the potential to affect the foraging and migratory success and behaviour of some marine species, particularly fish, but responses in some invertebrates have also been observed.

2.9.100 A detailed appraisal of EMF impacts to fish and shellfish is presented in **Application Document 6.2.4.4 Part 4 Marine Chapter 3 Fish and Shellfish**.

2.9.101 When assessing the effect of EMF, several factors should be considered, including the design of the cable, the surrounding environmental conditions including water movement, and species sensitivities (Gill, Hutchison, & Desender, 2023). The earth's ambient geomagnetic field varies slightly with geographic location; it is around 50 micro-Tesla (μT) in the UK and surrounding waters (EMFs, 2022). EMF will be emitted for the duration of operational life of the Proposed Project, from the subsea cables. A project-specific EMF assessment (**Application Document 6.5 Electric and Magnetic Field Compliance Report**) found that highest magnetic fields were observed when the burial depth of the cables was shallowest. Irrespective of the burial depth the magnetic fields reduce rapidly with distance from the cables due to bundling of the cables. The maximum magnetic fields calculated for cables buried 0.5m deep and at the seabed were 204.9 µT compared to when cables were buried 2.5m deep, the magnetic fields were 8.3 µT suggesting only a very localised effect and levels lowered below background.

Sensitivity

2.9.102 Sensitivity to the EMF emissions depends on the sensitivity of the species associated with benthic habitats. There is very little information about the sensitivity of benthic species to EMF but there have been a small number of investigations in laboratory experiments. There is evidence from studies that some benthic invertebrates can detect EMF. For example, mussels, shrimp (*Crangon crangon)* and crabs (*Rhithropanopeus harrisii)*, were all exposed to a static B-field of 3,700 µT for three months, and no differences in survival between experimental and control animals were detected (Bochert & Zettler, 2006). However, in another laboratory study with common rag worm (*H. diversicolor*) there was no evidence of avoidance or attraction behaviours at an EMF of 1000 µT (Jakubowska, Urban-Malinga, Otremba, & Andrulewicz, 2019) a much higher intensity than will the emitted by the Offshore Scheme.

2.9.103 For crustacean species which have a high level of association with the benthos, such as the edible crab, EMF strengths of 250 µT were found to have limited physiological and behavioural impacts (Scott, Harsanyia, & Lyndon, 2018). At exposure of 500 µT and 1000 µT stress responses were detected in histological indicators but crabs also showed a clear attraction at these EMF levels. However, this attraction has been observed to not impact overall crab movements (Scott, et al., 2021) and, in an experiment with American lobsters, only subtle behavioural responses to HVDC EMF were observed (Hutchison, et al., 2018). There were notable changes in movement and distribution within an enclosed space, but the EMF did not represent a barrier to lobster movements, and no significant impact was observed overall. However, these investigations used EMF strengths at a much higher intensity than that anticipated to be emitted by the Proposed Project.

2.9.104 For embryonic stages of edible crab and European lobster a decrease in carapace heights, total lengths and eye diameters have been observed following exposure to EMF strengths of 2.8 mT (Harsanyi, et al., 2022). However, considering these stages are found in the water column, it is not anticipated that there will be any impact to pelagic embryonic life stages due to the effects from EMF emissions.

2.9.105 The worst-case scenario for the Offshore Scheme (**Application Document 6.5 Electric and Magnetic Field Compliance Report**), indicates field intensities up to 204.9 µT at the seabed surface at a burial depth of 0.5m, which is significantly lower than the field strength used in these studies, which showed no effect. Therefore, after consideration of the available literature and project specific EMF modelling analyses it is concluded that detection by invertebrates may be possible, but that at the levels of EMF produced by the cable responses are either negligible or absent. Therefore, benthic invertebrate species of both adult and embryonic stages, are considered to have a low sensitivity to EMF emissions, particularly at the levels resulting from the Proposed Project.

2.9.106 Habitat indicative of Annex I ‘sandbanks which are slightly covered by sea water all the time,’ was observed in the Offshore Scheme. However, it is not specifically protected under any designated site. Margate and Long Sands SAC is 3.0 km west of the Offshore Scheme and is the nearest site designated for the protected of Annex I sandbanks (JNCC, 2017a). Sandbanks are often low in biodiversity as they are often subject to significant wave and tidal energy. Thus, this habitat is considered to have a low vulnerability and low sensitivity to EMF emissions.

2.9.107 Similarly, within the Offshore Scheme there two additional NERC habitats of principal importance – ‘communities on circalittoral rock’ and ‘subtidal sands and gravels’. These are not specifically protected by a designated site but are still considered to be of medium importance. These habitats support a range of benthic organisms, however, there are few studies that indicate that benthic species are adversely impacted by the increases in EMF emissions expected from the Offshore Scheme. Thus, the sensitivity of these habitats is considered low.

2.9.108 Moreover, during the benthic surveys, *M. edulis* beds were identified within the Offshore Scheme Boundary. These mussel beds are listed as a Habitat of Principal Importance under Section 41 of the NERC Act (2006) and at KP109, the aggregations of this *M. edulis* were observed in continuous reef formations (**Application Document 6.3.4.2.D Appendix 4.2.D Interim Subtidal Survey Report (Additional Surveys)**), and therefore, are indicative of Annex I habitat ‘biogenic reefs’ (H1170). However, this habitat is not specifically protected under any designated site. There is little evidence to suggest that *M. edulis* are sensitive to MEF emissions (Tyler-Walters, 2008). *S. spinulosa* was also observed within the Offshore Scheme Boundary, but similarly reef formations were not identified (Gubbay, 2007); and similarly, there is little evidence to suggest that *S. spinulosa* is sensitive to EMF emissions (Jackson & Hiscock, 2008).

2.9.109 The Offshore Scheme Boundary runs parallel to the Goodwin Sands MCZ for approximately 3.2 km from approximately KP107.3 to KP110.5, ensuring avoidance of the designated features of the site. Therefore, due to the localised nature of any disturbance associated with EMF effects, it is not anticipated that there will be any impact of the Goodwin Sands MCZ.

Magnitude of impact

2.9.110 In a worst-case scenario, the cables will be bundled, which are known to emit significantly lower magnetic fields due to cancellation of the magnetic fields between poles. Additionally, the Proposed Project has a target burial depth between 1 and 2 .5 m below the seabed (as per control measure FSF01 in **Application Document 7.5.3.1 Appendix A Outline Code of Construction Practice**, Section 2.8), EMF is only expected to have a very localised effect. Modelling of the predicted EMF emissions for the Offshore Scheme. (**Application Document 6.5 Electric and Magnetic Field Compliance Report)** shows that the geometric field for a bundled cable design buried at 1 m, indicates field intensity of 51.5 μT at the seabed surface, only slightly higher than background levels indicating a localised effect.

2.9.111 Considering the above, emissions are considered to be negligible beyond 5 m from the cable route. Additionally, if any habitats of conservation concern are identified in pre-installation surveys, the Proposed Project will micro-route the cable to avoid or minimise interactions.

2.9.112 Therefore, where burial can be reached, EMF emissions are unlikely to be at a level likely to affect benthic habitats and species.

Significance of effect

2.9.113 Based on the low sensitivity of benthic ecological receptors, the impact of disturbance from EMF emissions has been assessed as having a small magnitude which results in a **minor effect**, which is considered to be not significant.

Maintenance effects

2.9.114 The Offshore Scheme is designed for a lifespan of approximately 40-60 years. The cable system installation is designed such that a regular maintenance regime is not required to maintain the integrity of the link.

2.9.115 See route preparation and cable installation, noting that durations and extents of activities will be significantly reduced.

Decommissioning Phase

2.9.116 Following the completion of the Operational phase, the Decommissioning phase will take place. As this work is planned decades into the future, it is unknown what the exact methodology will be for decommissioning, as this will be based on the best available technology available at the time of decommissioning.

2.9.117 In the years leading up to the end of the Project's operational life, options for decommissioning will be evaluated through integrated environmental, technical, and economic assessments. The objective in undertaking these assessments will be to minimise the short- and long-term effects on the environment, whilst ensuring that the sea is safe for other users to navigate. The level of decommissioning will be based upon the regulations, best practices, and available technology at the time of decommissioning. The principal options for decommissioning include:

- full removal of the cable; and
- leaving the cable buried in-situ.

2.9.118 In the event of the full removal of the cable, this would have the potential to cause similar impacts to the Construction Phase of the Proposed Project. Should the cable be left in-situ, there would likely be no impact pathways to benthic receptors. Thus, as a worst-case scenario, impacts during decommissioning may be of a similar magnitude to Construction Phase activities, depending upon the decommissioning option selected. Therefore, as a worst case, the effects to benthic ecology are predicted to result in a **minor effect**, which is not significant.

2.10 Additional Mitigation and Enhancement Measures

2.10.1 Aside from the embedded mitigation measures, as aforementioned in Section 2.8, no additional mitigation measures or monitoring have been recommended as a result of the impact appraisal.

2.10.2 There will be pre-construction surveys undertaken, to inform the final cable route design and installation. Where habitats of principal importance are identified during these pre-construction surveys, and there is potential for impacts on these habitats, a Benthic Mitigation Plan will be prepared, in consultation with stakeholders, as detailed in commitment ID BE05 in **Application Document 7.5.3.2 CEMP Appendix B Register of Environmental Actions and Commitments (REAC)**.

2.11 Residual Effects and Conclusions

2.11.1 As no additional mitigation was required because there were no likely significant effects to benthic ecology identified, the residual effects of the Proposed Project remain as reported in Section 2.9.

2.12 Transboundary Effects

2.12.1 A transboundary effect is any significant adverse effect on the environment resulting from human activity, the physical origin of which is situated wholly or in part within an area under the jurisdiction of another State.

2.12.2 All works associated with the Proposed Project fall within the UK jurisdiction (12 NM). Given the distance of the Proposed Project from French waters (approximately 25 km), no significant transboundary effects have been identified. Predicted disturbance from the Proposed Project is short term and local and are therefore not anticipated to be sufficient to influence benthic ecology receptors outside UK waters, and subsequently cause transboundary effects.

Table 2.19 Summary of benthic ecology effects

Phase	Potential Impact	Receptor	Sensitivity	Effect		Additional Mitigation Measures	Residual Effect	
				Magnitude	Significance		Magnitude	Significance
Construction	Temporary physical disturbance to benthic habitats and species	Benthic habitats and species	Low - medium	Small	Minor (Not significant)	No	Small	Minor (Not significant)
	Temporary increase in SSC and sediment deposition leading to increased turbidity and smothering effects and possible contaminant mobilization		Negligible-medium	Small	Minor (Not significant)	No	Small	Minor (Not significant)
	Changes to marine water quality during cable installation and cable lay from the use of drilling fluids		Low	Small	Minor (Not significant)	No	Small	Minor (Not significant)
	Underwater sound impacts on marine invertebrates		Negligible	Negligible	Negligible (Not significant)	No	Negligible	Negligible (Not significant)

Phase	Potential Impact	Receptor	Sensitivity	Effect		Additional Mitigation Measures	Residual Effect	
				Magnitude	Significance		Magnitude	Significance
Operation and Maintenance	Direct loss of subtidal benthic habitats and species due to placement of hard substrates on the seabed		Low - high	Small	Minor (Not significant)	No	Small	Minor (Not significant)
	Introduction and spread of INNS via the addition of cable protection during construction and maintenance		Low - medium	Small	Minor (Not significant)	No	Small	Minor (Not significant)
	Effects from thermal emissions		Low	Negligible	Negligible (Not significant)	No	Negligible	Negligible (Not significant)
	Effects from EMF emissions		Low	Small	Minor (Not significant)	No	Small	Minor (Not significant)
	Maintenance effects	Potential effects the same as route preparation and cable installation						
Decommissioning	Decommissioning effects	Potential effects the same as route preparation and cable installation						

2.13 References

Next Geosolutions. (2024). *Sea Link Marine Cable Route Survey: Volume 7 – Field Report - Benthic. P2097-010-REP-008.* National Grid.

Adams, T. P., Miller, R. G., Aleynik, D., & Burrows, M. T. (2014). Offshore marine renewable energy devices as stepping stones across biogeographical boundaries. *Journal of Applied Ecology, 51*(2), 330-338.

AECOM. (2022). *Eastern Green Link 2: Environmental Appraisal Report Volume 2, Chapter 9: Fish and Shellfish Ecology. For: National Grid Electricity Transmission and Scottish Hydro Electric Transmission Plc.* National Grid. Retrieved from https://marine.gov.scot/sites/default/files/c9_environmental_appraisal_report_-_fish_and_shellfish_ecology_0.pdf

Ashley, M., Budd, G. C., Lloyd, K. A., & Watson, A. (2024). *Hediste diversicolor and oligochaetes in littoral mud. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews.* Plymouth: Marine Biological Association of the United Kingdom.

Bamber, R. N. (1985). *Coarse substrate benthos of Kingsnorth outfall lagoon, with observations on Petricola pholadiformis Lamarck.* Central Electricity Research Laboratories Report TPRD/L 2759/N84.

Bamber, R. N. (1987). Some aspects of the biology of the North American ostracod Sarsiella zostericola Cushman in the vicinity of a British power station. *Journal of Micropalaeontology, 6*, 57-62.

Blanchard, M. (1997). Spread of the slipper limpet Crepidula fornicata (L. 1758) in Europe. Current State and consequences. *Ecology of Maine Molluscs, 61*(2), 109-118.

Bochert, R., & Zettler, M. L. (2006). Effect of electromagnetic fields on marine organisms. In *Offshore Wind Energy.* Springer Berlin Heidelberg.

Caprasso, E., Jenkins, S., Frost, M., & Hinz, H. (2010). Investigation of benthic community change over a century-wide scale in the western English Channel. *Journal of the Marine Biological Association of the United Kingdom, 90*(6), 1161-1172.

Carrol, A., Przeslawski, R., Duncan, A., Grunning, M., & Bruce, B. (2017). A critical review of the potential impacts of marine seismic surveys on fish and invertebrates`. *Marine Pollution Bulletin, 114*(1), 9-24.

CCME. (2001). *Canadian Sediment Quality Guidelines for the Protection of Aquatic Life.* Canadian Council of Ministers of the Environment. Retrieved from https://www.pla.co.uk/Environment/Canadian-Sediment-Quality-Guidelines-for-the-Protection-of-Aquatic-Life

CEFAS. (2001). *The impact of disposal of marine dredged material on the Thanet Coast and Sandwich Bay Candidate Special Areas of Conservation.* Centre for Environment Fisheries and Aquaculture Science.

CEFAS. (2022). OneBenthic Portal. Retrieved from https://openscience.cefas.co.uk/

CIEEM. (2018). *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2. Chartered Institute of Ecology and Environmental Management.* Retrieved from https://cieem.net/wp%02content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine%02V1.2-April-22-Compressed.pdf

CIEEM. (2018). *Guidelines for Eoclogical Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine.* Winchester: Chartered Institute of Ecology and Environmental Management.

Collins, P. (2010). *Modified EC Habitats Directive Modified EC Habitats Directive Annex I Sabellaria spinulosa Reefiness Assessment Method.*

Connor, D. W., Allen, J. H., Golding, N., Howell, K. L., Lieberkneckt, L. M., Northern, K. O., & Reker, J. B. (2004). *The marine habitat classification for Britain and Ireland Version 04.05.* Peterborough: JNCC.

Coolen, J. W., Boon, A. R., Croojjmans, R., van Pelt, H., Kleissen, F., Gerla, D., . . . Luttikhuizen, P. C. (2020). Marine stepping-stones: Connectivity of Mytilus edulis populations between offshore energy installations. *Molecular Ecology, 29*, 686-703.

Davies, J., Baxter, J., Bradley, M., Connor, D., Khan, J., Murray, E., . . . Vincent, M. (2001). *Marine Monitoring Handbook.* Peterborough: JNCC.

De-Bastos, E. S., & Watson, A. (2023). *Lagis koreni and Phaxas pellucidus in circalittoral sandy mud. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews.* Plymouth: Marine Biological Association of the United Kingdom.
DECC. (2024a). *Overarching National Policy Statement for Energy (EN-1)*. Retrieved from https://assets.publishing.service.gov.uk/media/65bbfbdc709fe1000f637052/overarching-nps-for-energy-en1.pdf
DECC. (2024b). *Overarching National Policy Statement for Renewable Energy Infrastructure (EN-3)*. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147382/NPS_EN-3.pdf
DECC. (2024c). *Overarching National Policy Statement for Electricity Networks Infrastructure (EN-5)*. Retrieved from https://assets.publishing.service.gov.uk/media/64252f852fa848000cec0f53/NPS_EN-5.pdf
Defra. (2014). *East Inshore and East Offshore Marine Plans*. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/312496/east-plan.pdf
Defra. (2019a). *Goodwin Sands MCZ.* Retrieved from https://assets.publishing.service.gov.uk/media/5f50fa2d8fa8f535b7ed3f6c/mcz-goodwin-sands-2019.pdf
Defra. (2019b). *Thanet Coast Marine Conservation Zone.* Defra. Retrieved from https://assets.publishing.service.gov.uk/media/5f560c2dd3bf7f4d796edc60/mcz-thanet-coast-2019.pdf
Defra. (2021). *South East Inshore Marine Plan*. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1004493/FINAL_South_East_Marine_Plan__1_.pdf
Defra. (2022). *Future coast project. National Network of Regional Coastal Monitoring Programmes classification.* Retrieved from https://coastalmonitoring.org/ccoresources/futurecoast/
Defra. (2024). *Magic Interactive Mapping*. Retrieved from https://magic.defra.gov.uk/home.htm
Dover District Council. (2022, October). *Dover District LOcal Plan to 2040.* Retrieved from doverdistrictlocalplan.co.uk: https://www.doverdistrictlocalplan.co.uk/uploads/Submission-Documents/SD01-Dover-District-Local-Plan-to-2040-Regulation-19-Submission-Document-Oct-22.pdf
East Suffolk Council. (2020, September). *East-Suffolk-Council-Suffolk-Coastal-Local-Plan.pdf.* Retrieved from eastsuffolk.gov.uk: https://www.eastsuffolk.gov.uk/assets/Planning/Planning-Policy-and-Local-Plans/Suffolk-Coastal-Local-Plan/Adopted-Suffolk-Coastal-Local-Plan/East-Suffolk-Council-Suffolk-Coastal-Local-Plan.pdf
EEA. (2021). *EUNIS habitat classification.* Retrieved from https://www.eea.europa.eu/data-and-maps/data/eunis-habitat-classification-1
Elliot, M., Nedwell, S., Jones, N. V., Read, S. J., Cutts, N. D., & Hemingway, K. L. (1998). *Intertidal sand and mudflats & subtidal mobile sandbanks (Vol. II). An overview of dynamic and sensitivity for conservation management of marine SACs.* Scottish Association for Marine Science for the UK Marine SACs Project.
Emeana, C. J., Hughes, T. J., Dix, J. K., Gernon, T. M., Henstock, T. J., Thompson, C. E., & Pilgrim, J. A. (2016). The thermal regime around buried submarine high-voltage cables. *Geophysical Journal International, 206*(2), 1051-1064.
Emeana, C. J., Hughes, T. J., Dix, J. K., Gernon, T. M., Henstock, T. J., Thompson, C. E., & Pilgrim, J. A. (2016). The thermal regime around buried submarine high-voltage cables. *Geophysical Jounral International, 206*(2#), 1051-1064.
EMFs. (2022). *Electric and magnetic fields and health*. Retrieved from EMFs.info: https://www.emfs.info/living-or-buying-near-an-interconnector#:~:text=The%20Earth%20has%20its%20own,field%20that%20compasses%20respond%20to.
EMODnet. (2021). *EUSeaMap*. Retrieved from https://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/
Essink, K. (1999). Ecological effects of dumping of dredged sediments; options for management. *Journal of Coastal Conservation, 5*, 69-80.

Gill, A. B., Hutchison, Z. L., & Desender, M. (2023). Electromagnetic Fields (EMFs) from subsea power cables in the natural marine environment. . *Technical Workshop, Royal Institute, London. Cefas Project Report for Crown Estate Offshore Wind Evidence and Change Programme*, 66 pp.

Golding, N., Albrecht, J., & McBreen, F. (2020). *Refining the criteria for defining areas with a 'low resemblance' to Annex I stony reef: Workshop Report.* JNCC, Peterborough, ISSN 0963-8091: JNCC Report No. 656. Retrieved from https://data.jncc.gov.uk/data/4b60f435-727b-4a91-aa85-9c0f99b2c596/jncc-report-656.pdf

Gubbay, S. (2007). *Defining and managing Sabellaria spinulosa reefs: Report of an interagency workshop.* JNCC, Peterborough, ISSN 0963-8091.: JNCC report No. 405. Retrieved from https://data.jncc.gov.uk/data/ecdbc5ba-e200-47e3-b7c6-adf464287712/JNCC-Report-405-FINAL-WEB.pdf

Harrison, P. A., Berry, P. M., & Dawson, T. P. (2001). *Climate Change and Nature Conservation in Britain and Ireland: Modelling natural resource responses to climate change (the MONARCH project).* Oxford: UKCIP Technical Report.

Harsanyi, P., Scott, K., Easton, B., de la Cruz Oritz, G., Chapman, E., Piper, A., . . . Lyndon, A. (2022). The Effects of Anthropogenic Electromagnetic Fields (EMF) on the Early Development of Two Commercially Important Crustaceans, European Lobster, Homarus gammarus (L.) and Edible Crab, Cancer pagurus (L.). *Journal of Marine Science and Engineering, 10*(5), 564-582.

Hicks, N., Liu, X., Gregory, R., Kenny, J., Lucaci, A., Lenzi, L., . . . Duncan, K. (2018). Temperature driven changes in benthic bacterial diversity influences biogeochemical cycling in coastal sediments. *Frontiers in microbiology*, 9, p.1730.

Hicks, N., Lui, X., Gregory, R., Kenny, J., Lucaci, A., Lenzi, L., . . . Duncan, K. R. (2018). Temperature driven changes in benthic bacterial diversity influences geochemical cycling in coastal sediments. *Froteirs in Marine Science, 9*(1730).

Hiscock, K., Southward, A., Titley, I., Jory, A., & Hawkins, S. (2001). *The Impact of Climate Change on Subtidal and Intertidal Benthic Species in Scotland. Survey and Monitoring Series Number 182.* Perth: Scottish Natural Heritage Research.

HM Government. (1981). *The Wildlife and Countryside Act*. Retrieved from https://www.legislation.gov.uk/ukpga/1981/69

HM Government. (2006). *Section 41 of the Natural Environment and Rural Communities Act*. Retrieved from https://www.legislation.gov.uk/ukpga/2006/16/section/41.

HM Government. (2009). *Marine and Coastal Access Act*. Retrieved from https://www.legislation.gov.uk/ukpga/2009/23/contents

HM Government. (2010). *The Marine Strategy Regulations*. Retrieved from https://www.legislation.gov.uk/uksi/2010/1627/contents/made

HM Government. (2011). *UK Marine Policy Statement* . Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf

HM Government. (2017a). *The Conservation of Habitats and Species Regulations*. Retrieved from https://www.legislation.gov.uk/uksi/2017/1012/contents/made

HM Government. (2017b). *The Conservation of Offshore Marine Habitats and Species Regualtions*. Retrieved from https://www.legislation.gov.uk/uksi/2017/1013/contents/made

HM Government. (2017c). *The Water Environment (Water Framework Directive) (England and Wales) Regulations*. Retrieved from https://www.legislation.gov.uk/uksi/2017/407/contents/made [January 2023].

HM Government. (2023). *National Planning Policy Framework. Retrieved from the revised National Planning Policy Framework*. Retrieved from https://www.gov.uk/government/publications/national-planning-policy-framework--2

Hutchinson, Z. L., Hendrick, V. J., Burrows, M. T., Wilson, B., & Last, K. S. (2016). Buried Alive: The Behavioural Response of the Mussels, Modiolus modiolus and Mytilus edulis to Sudden Burial by Sediment. *PLoS ONE, 11*(3), e0151471.

Hutchison, Z. L., Bartley, M. L., Deggraer, S., English, P., Khan, A., Livermore, J., . . . King, J. W. (2020). Offshore wind energy and benthic habitat changes: Lessons from Block Island Wind Farm. *Oceanography, 33*(4), 58-69.

Hutchison, Z. L., Sigray, P., He, H., Gill, A., King, J., & Gibson, C. (2018). *Electromagnetic Field (EMF) Impacts on Elasmobranch (Shark, Rays, and Skates) and American Lobster Movement and*

Migration From Direct Current Cables. Sterling (VA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 3.
Hutchison, Z., Gill, A., Sigray, P., He, H., & King, J. (2020). Anthropogenic electromagnetic fields (EMF) influence the behaviour of bottom-dwelling marine species. *Scientific Reports* .
IMO. (1972). *Convention on the International Regulations for Preventing Collisions at Sea,.* COLREGs. Retrieved from https://www.imo.org/en/About/Conventions/Pages/COLREG.aspx
IMO. (1974). *nternational Convention for the Safety of Life at Sea (SOLAS) 1974.* Retrieved from https://treaties.un.org/doc/Publication/UNTS/Volume%201184/volume-1184-I-18961-English.pdf
IMO. (1983). *International Convention for the Prevention of Pollution from Ships (MARPOL).* Retrieved from https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx
Irving, R. (2009). *The identification of the main characteristics of stony reef habitats under the Habitats Directive. Summary report of an inter-agency workshop 26-27 March 2008.* JNCC, Peterborough, ISSN 0963-8091.: JNCC Report No. 432. Retrieved from https://data.jncc.gov.uk/data/21693da5-7f59-47ec-b0c1-a3a5ce5e3139/JNCC-Report-432-FINAL-WEB.pdf
IUCN. (2021). *The IUCN Red List of Threatened Species* . Retrieved from IUCN RedList: https://www.iucnredlist.org/
Jackson, A., & Hiscock, K. (2008). *abellaria spinulosa Ross worm. In Tyler-Walters H. and Hiscock K. Marine Life Information Network: Biology and Sensitivity Key Information Reviews.* Plymouth: Marine Biological Association of the United Kingdom.
Jackson, A., & Hiscock, K. (2008). *Sabellaria spinulosa Ross worm. In Tyler-Walters H. and Hiscock K. Marine Life Information Network: Biology and Sensitivity Key Information Reviews.* Plymouth: Marine Biological Association of the United Kingdom.
Jakubowska, M., Urban-Malinga, B., Otremba, Z., & Andrulewicz, E. (2019). Effect of low frequency electromagnetic field on the behavior and bioenergetics of the polychaete Hediste diversicolor. *Marine Environmental Research, 150*(104766).
Jenkins, C., Eggleton, J., Barry, J., & O'Connor, J. (2018). Advances in assessing Sabellaria spinulosa reefs for ongoing monitoring. . *Ecology and Evolution*, 1-15.
JNCC. (2010). *Handbook for Phase 1 habitat survey - a technique for environmental audit. ISBN 0 86139 636 7.* JNCC.
JNCC. (2015). *Thanet Coast and Sandwich Bay SPA*. Retrieved from JNCC: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9012071.pdf
JNCC. (2017a). *Margate and Long Sands SAC*. Retrieved from JNCC: https://sac.jncc.gov.uk/site/UK0030371
JNCC. (2017b). *Outer Thames Estuary SPA*. Retrieved from JNCC: https://jncc.gov.uk/our-work/outer-thames-estuary-spa/
JNCC. (2019). *Southern North Sea SAC* . Retrieved from JNCC: https://jncc.gov.uk/our-work/southern-north-sea-mpa/
JNCC. (2021). *Annex I Habitats*. Retrieved from https://sac.jncc.gov.uk/habitat/
Kuhnz, L. A., Buck, K., Lovera, C., Whaling, P. J., & Barry, J. P. (2015). *Potential impacts of the Monterey Accelerated Research System (MARS) cable on the seabed and benthic faunal assemblages.* Monterey Bay Aquarium Research Institute, 33.
Last, K. S., Hendrick, V. J., Beveridge, C. M., & Davies, A. J. (2011). *Measuring the effects of suspended particulate matter and smothering on the behaviour, growth and survival of key species found in areas associated with aggregate dredging.* Report for the Marine Aggregate Levy Sustainability Fund MEPF 08/P76.
Lewis, L., Davenport, J., & Kelly, T. (2002). A study of the impact of a pipeline construction on estuarine benthic invertebrate communities. *Estuarine, Coastal and Shelf Science, 55*(2), 213-221.
Limpenny, D., Foster-Smith, R., Edwards, T., Hendrick, V., Diesing, M., Eggleton, J., . . . Reach, I. (2010). *Best methods for identifying and evaluating Sabellaria spinulosa and cobble reef. Aggregate Levy Sustainability Fund Project MAL0008. 134 pp., ISBN - 978 0 907545 33 0.* Peterborough: Joint Nature Conservation Committee.
London Array Limited . (2005). *Environmental Statement Volume 1: Offshore Works.* RPS Group Plc.
Marine Data Exchange. (2021). *JNCC, Offshore Wind Evidence and Change Programme, Offshore Wind Environmental Evidence Register.* Retrieved from https://www.marinedataexchange.co.uk/details/3480/2021-jncc-offshore-wind-evidence-and-change-programme-offshore-wind-environmental-evidence-register-/summary

MarLIN. (2023). *Marine Life Information Network*. Retrieved from https://www.marlin.ac.uk/

Maurer, D., Keck, R. T., Tinsman, J. C., Leatham, W. A., Wethe, C., Lord, C., & Church, T. M. (1986). ertical migration and mortality of marine benthos in dredged material: a synthesis. *Internationale Revue der Gesamten Hydrobiologie, 71*, 49-63.

McQuillan, R. M., Tillin, H. M., Williams, E., Tyler-Walters, H., Llyoyd, K. A., & Watson, A. (2024). *Lanice conchilega in littoral sand. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews.* Plymouth: Marine Biological Association of the United Kingdom.

Meissner, K., Schabelon, H., Bellebaum, J., & Sordyl, H. (2006). *Impacts of submarine cables on the marine environment - A Literature Review.* Institute of Applied Ecology for the German Federal Agency for Nature Conservation. Retrieved from https://tethys.pnnl.gov/sites/default/files/publications/Meissner-et-al-2006.pdf

Ministry for Levelling Up, Housing and Communities. (2024). *National Planning Policy Framework.* Retrieved July 09, 2024, from https://www.gov.uk/government/publications/national-planning-policy-framework--2

MMO. (2014). *Cefas Chemical Action Levels*. Retrieved from https://www.gov.uk/guidance/marine-licensing-sediment-analysis-and-sample-plans###Suitability%20of%20material

National Grid. (2022). *Sealink Environmental Impact Assessment Scoping Report.* National Grid.

Natural England; JNCC. (2022). *Nature conservation considerations and environmental best practice for subsea cables for English Inshore and UK offshore waters.*

Nobel-James, T., Jesus, A., & McBreen, F. (2018). *Monitoring guidance for marine benthic habitats (Revised 2018). JNCC Report No. 598.* Peterborough: JNCC.

O'Riordan, R. M., Culloty, S. C., McAllen, R., & Gallagher, M. C. (2020). The biology of Austrominius modestus (Darwin) in its native and invasive range. *Oceanography and Marine Biology: An Annual Review, 58*, 1-78.

OSPAR. (2010). *Intertidal Mytilus edulis beds on mixed and sandy sediments. Case Reports for the OSPAR List of threatened and/or declining species and habitats - Update.* OSPAR Commission.

OSPAR Commission. (2008). *OSPAR List of Threatened and/or Declining Species and Habitats*. Retrieved from https://www.ospar.org/documents?d=32794

OSPAR Commission. (2009b). *Background Document on CEMP assessment criteria for the QSR 2010.* OSPAR.

OSPAR Commission. (2013). *Background document on Sabellaria spinulosa reefs.* Retrieved from https://www.ospar.org/documents?v=7342#:~:text=The%20OSPAR%20List%20recognises%20that,in%20Regions%20II%20and%20III.&text=The%20nomination%20of%20S.,Criteria%20(OSPAR%2C%202003).

OSPAR Commission. (2023). *Environmental Impacts of Human Activites: Subsea Cables within the OSPAR Maritime Area: Background document on tachnical considerations and potential environmental impacts.* OSPAR Commission.

Parry, M. E. (2015). *Guidance on assigning benthic biotopes using EUNIS or the Marine Habitat Classification of Britain and Ireland. JNCC Report No. 546.* Peterborough: JNCC.

PINS. (2022). *Scoping Opinion: Proposed Sea Link, Case Reference: EN020026.* Retrieved from https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN020026/EN020026-000027-EN020026-Scoping-Opinion

Popper, A. N., & Hawkins, A. D. (2018). The importance of particle motion to fishes and invertebrates. *The Journal of the Acoustical Society of America, 143*(1), 470-488.

Riley, K., & Ballerstedt, S. (2005). *Spirobranchus triqueter. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme.* Plymouth: Marine Biological Association of the United Kingdom. Retrieved from https://www.marlin.ac.uk/species/detail/1794

RPS. (2019). *Review of cable installation, protection, mitigation, and habitat recoverability.* The Crown Estate.

Scott, K., Harsanyi, P., Easton, B., Piper, A., Rochas, C., & Lyndon, A. (2021). Exposure to Electromagnetic Fields (EMF) from Submarine Power Cables Can Trigger Strength-Dependent Behavioural and Physiological Responses in Edible Crab, Cancer pagurus (L.). *Journal of Marine Science and Engineering, 9*(7), 16.

Scott, K., Harsanyia, P., & Lyndon, A. L. (2018). Understanding the effects of electromagnetic field emissions from Marine Renewable Energy Devices (MREDs) on the commercially important edible crab, Cancer pagurus (L.). *Marine Pollution Bulletin, 131*, 580-588.

Sherwood, J., Chidley, S., Crockett, P., Gwyther, D., Ho, P., Stewart, S., . . . Williams, A. (2016). Installation and operational effects of a HVDC submarine cable in a continental shelf setting: Bass Strait, Australia. *Journal of Ocean Engineering and, 1*, 337-353.

Solan, M., Hauton, C., Godbold, J. A., Wood , C. L., Leighton, G. E., & White, P. (2016). Anthropogenic sources of underwater sound can modify how sediment-dwelling invertebrates mediate ecosystem properties. *Scientific Reports, 6*(1), 1-9.

Sole, M., Kaifu, K., Mooney, T. A., Nedelec, S. L., Olivier, F., Radford, A. N., . . . Andre, M. (2023). Marine invertebrates and noise. *Fronteirs in Marine Science, 10*(1129057), 1-34.

Spencer, B. E., Edwards, D. B., Kaiser, M. J., & Richardson, C. A. (1994). patfalls of the non-native Pacific oyster, Crassostrea gigas, in British waters. *Aquatic Conservation: Marine and Freshwater Ecosystems, 4*(3), 203-217.

Taormina, B., Bald, J., Want, A., Thouzeau, G., Lejart, M., Desroy, M., & Carlier, A. (2018). A review of potential impacts of submarine power cables on the marine environment: Knowledge gaps, recommendations and future directions. *Renewable and Sustainable Energy Reviews, 96*, 380-391.

The Kent Habitat Survey Partnership. (2003). *Kent Habitat Survey 2003, GB000329.*

Tillin, H. M., Budd, G. C., Lloyd, K. A., & Watson, A. (2023). *bra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews.* Plymouth: Marine Biological Association of the United Kingdom. Retrieved from https://www.marlin.ac.uk/habitat/detail/62

Tillin, H. M., Garrard, S. L., Lloydd, K. S., & Watson, K. A. (2023). *Nephtys cirrosa and Bathyporeia spp. in infralittoral sand. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews.* Plymouth: Marine Biological Association of the United Kingdom.

Tillin, H. M., Kessel, C., Sewell, J., Wood, C. A., & Bishop, J. D. (2020). *Assessing the impact of key Marine Invasive Non-Native Species on Welsh MPA habitat features, fisheries, and aquaculture. NRW Evidence Report. Report No: 454.* Natural Resources Wales.

Tillin, H. M., Ryament, W. J., Williams, E., Tyler-Walters, H., Lloyd, K. A., & Watson, A. (2024). *Hediste diversicolor and Macoma balthica in littoral sandy mud. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews.* Plymouth: Marine Biological Association of the United Kingdom.

Tillin, H., Mainwaring, K., Tyler-Walters, H., Williams, E., & Watson, A. (2024). *Mytilus edulis beds on sublittoral sediment. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews.* Plymouth: Marine Biological Association of the United Kingdom.

Tillin, H., Watson, A., Tyler-Walters, H., Mieszkowska, N., & Hiscock, K. (2022). *Defining Marine Irreplaceable Habitats: Literature review. NECR474. Natural England.*

Tittley, I., Spurrier, C., & Chimonides, P. (2002). *Thanet intertidal survey: Assessment of favourable condition of reef and sea-cave features in the Thanet Coast cSAC. English Nature Research Reports Number 568. January 2002.*

Tyler-Walters, H. (2008). *Mytilus edulis Common mussel. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews.* Plymouth: Marine Biological Association of the United Kingdom.

Tyler-Walters, H., De-Bastos, E. S., & Watson, A. (2023). *Ampelisca spp., Photis longicaudata and other tube-building amphipods and polychaetes in infralittoral sandy mud. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews.* Plymouth: Marine Biological Association of the United Kingdom. Retrieved from https://www.marlin.ac.uk/habitat/detail/1230

Tyler-Walters, H., Tillin, H. M., & Watson, A. (2024). *pirobranchus triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews.* Plymouth: Marine Biological Association of the United Kingdom. Retrieved from https://www.marlin.ac.uk/habitat/detail/177

UKOOA. (2001). *Contaminant Status of the North Sea.*

Vorberg, R. (2000). Effects of shrimp fisheries on reefs of Sabellaria spinulosa (Polychaeta). *ICES Journal of Marine Science, 57*, 1416-1420.

Wale, M. A., Simpson, S. D., & Radford, A. N. (2013). Size-dependent physiological responses of shore crabs to single and repeated playback of ship noise. *Biol Letters, 9*(20121194).
Walther, G., Post, E., Convey, P., Menzel, A., Parmesan, C., Beebee, T. J., . . . Bairlein, F. (2002). Ecological responses to recent climate change. *Nature, 416*, 389-395.
Widdows, J., Bayne, B. L., Livingstone, D. R., Newell, R. I., & Donkin, P. (1979). Physiological and biochemical responses of bivalve molluscs to exposure to air. *Comparative Biochemistry and Physiology, 62a*, 301-308.
Wilson, D. P. (1929). The larvae of the British sabellarians. *Journal of the Marine Biological Association of the United Kingdom, 16*, 221-269.
Wyn, G., Brazier, D. P., & McMath, A. J. (2000). *CCW handbook for marine intertidal Phase 1 survey and mapping. CCW Marine Sciences Report: 00/06/01.*

Page intentionally blank

National Grid plc
National Grid House,
Warwick Technology Park,
Gallows Hill, Warwick.
CV34 6DA United Kingdom

Registered in England and Wales
No. 4031152
nationalgrid.com