Preliminary Environmental Information Report Volume 1

Chapter 18 Marine Physical Environment

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LIONLINK

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Glossary of Project Terminology

This Glossary has been provided to define terms used across a number of the LionLink Proposed Scheme documents.

Term	Definition
Applicant, the	National Grid Lion Link Limited (NGLLL)
Co-ordination	The process of people or entities working together.
Co-location	Where different elements of a project, or various projects, are located in one place.
Development Consent Order (DCO)	An order made by the Secretary of State pursuant to the Planning Act 2008 (as amended) granting development consent for a Nationally Significant Infrastructure Project. It grants consent to develop the approved project and may include (among other things) powers to compulsorily acquire land and rights where required and deemed marine licences for any offshore works.
Draft Order Limits	The area of land identified as being subject to the DCO application. The Draft Order Limits are made up of the land required both temporarily and permanently to allow for the construction, operation and maintenance, and decommissioning of the Proposed Scheme. All onshore parts of the Proposed Onshore Scheme are located within England and offshore parts of the Proposed Offshore Scheme are located within English territorial waters to 12 Nautical Miles and then up to the United Kingdom (UK) Exclusive Economic Zone (EEZ) boundary at sea.
Dutch Offshore Components	Is the term used when referring to the offshore elements of the Project within Dutch waters.
Environmental Impact Assessment (EIA)	The EIA is a systematic regulatory process that assesses the potential likely significant effects of a proposed project or development on the environment.
EIA Scoping Report	An EIA scoping report defines the proposed scope and methodology of the EIA process for a particular project or development. The EIA Scoping Report for the Proposed Scheme was submitted to the Planning Inspectorate with a request for the Secretary of State to adopt a scoping

Term	Definition
	opinion in relation to the Proposed Scheme on 6 March 2024.
Environmental Statement (ES)	The ES is a document that sets out the likely significant effects of the project on the environment. The ES is the main output from the EIA process. The ES is published as part of the DCO application.
Exclusive Economic Zone (EEZ)	The zone in which the coastal state exercises the rights under Part V of the United Nations Convention on the Law of the Sea. These rights relate principally to the water column and may extend to 200 nautical miles from baselines. This is distinct from territorial waters, which for the UK extend 12 nautical miles from the coast.
Landfall	The proposed Landfall is where the proposed offshore HVDC Submarine Cables are brought ashore and meets with the onshore proposed Underground HVDC Cables. This includes the Transition Joint Bay (TJB). The proposed Landfall will be located at Walberswick, and there will be no permanent above ground infrastructure at the proposed Landfall.
Landfall Site	The area where the Landfall may be located.
Multi-purpose interconnector (MPI)	A project where GB interconnection is combined with transmission of offshore generation within GB (and optionally within a connecting state).
National Grid Lion Link Limited (NGLLL)	The Applicant, a joint venture between National Grid Ventures and TenneT. NGLLL is a business within the wider National Grid Ventures portfolio.
National Grid Ventures (NGV)	Operates and invests in energy projects, technologies and partnerships to accelerate the development of a clean energy future. This includes interconnectors (such as the LionLink Project), allowing trade between energy markets and the efficient use of renewable energy resources.
Nationally Significant Infrastructure Projects (NSIP)	Major infrastructure developments in England and Wales for which development consent is required, as defined within Section 14 of the Planning Act 2008 (as amended). This includes any development which is subject to a direction by the relevant Secretary of State pursuant to Section 35 of the Planning Act 2008.
Offshore Hybrid Asset (OHA)	A project that combines cross-border interconnection with the transmission of offshore generation, this is an overarching term which covers

Term	Definition
	both multi-purpose interconnectors (MPI) and non-standard interconnectors (NSI).
Order Limits	The maximum extent of land within which the Proposed Scheme may take place, as consented.
Outline Offshore Construction Environmental Management Plan (Outline Offshore CEMP)	Describes the control measures and standards proposed to be implemented to provide a consistent approach to the environmental management of the construction activities of the Proposed Offshore Scheme.
Outline Onshore Code of Construction Practice (Outline Onshore CoCP)	Describes the control measures and standards proposed to be implemented to provide a consistent approach to the environmental management of the construction activities of the Proposed Onshore Scheme.
Planning Act 2008	The Planning Act 2008 being the relevant primary legislation for national infrastructure planning.
Planning Inspectorate (PINS)	The Planning inspectorate review DCO applications and make a recommendation to the Secretary of State, who will then decide whether to approve the DCO.
Preliminary Environmental Information Report (PEIR)	The PEIR is a document, compiled by the Applicant, which presents preliminary environmental information, as part of the statutory consultation process. This is defined by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 as containing information which "is reasonably required for the consultation bodies to develop an informed view of the likely significant environmental effects of the development (and of any associated development)" (Section 12 2. (b)). This PEIR describes the Proposed Scheme, sets out preliminary findings of the EIA undertaken to date, and the mitigation measures proposed to reduce effects. The PEIR is published at Statutory Consultation stage for information and feedback.
Project (the)	The LionLink Project (hereafter referred to as the 'Project') is a proposal by National Grid Lion Link Limited (NGLLL) and TenneT. The Project is a proposed electricity link between Great Britain (GB) and the Netherlands with a capacity of up to 2.0 gigawatts (GW) of electricity and will connect to Dutch offshore wind via an offshore platform in Dutch waters. The Project is the collective term used to refer to the proposal for all aspects (onshore and offshore) of

Term	Definition
	the proposed interconnector between GB and the Netherlands.
Proposed Offshore Scheme	The term used when referring to the offshore elements of the Proposed Scheme, seaward of the mean high-water springs to the EEZ boundary at sea.
Proposed Scheme	Used when referring to the GB scheme components of the Project, not including Dutch components. This includes both the onshore and offshore scheme components which are within UK territorial waters and up to the UK EEZ boundary at sea.
Scoping Opinion	A scoping opinion is requested from the Planning Inspectorate on behalf of the Secretary of State, to inform the requirements of EIA process and ultimately the ES which will be submitted as part of the application for development consent. Through the scoping process, the views of the statutory consultees and other relevant organisations on the proposed scope of the EIA are sought. A Scoping Opinion for the Proposed Scheme was issued by the Planning Inspectorate (on behalf of the Secretary of State) on 16 April 2024. The Applicant received a separate EIA Scoping Opinion from the Marine Management Organisation (MMO) (Reference DCO/2024/00005, dated 04 September 2024) as the MMO were unable to provide opinion to the Planning Inspectorate in time for the April 2024 deadline.
Scottish Power Renewables (SPR) East Anglia One North (EA1N) and East Anglia 2 (EA2) Consents (SPR EA1N and EA2 Consents)	The Orders made following the Scottish Power Renewables applications for development consent for the following projects: The East Anglia ONE North Offshore Wind Farm Order 2022; and East Anglia TWO Offshore Wind Farm Order 2022
Statutory Consultation	Consultation undertaken with the community and stakeholders in advance of the application for development consent being submitted to the Planning Inspectorate, on behalf of the Secretary of state, in accordance with the PA 2008.
TenneT	Operator of the electricity transmission network across the Netherlands.
Transition Joint Bay (TJB)	An underground structure at the Landfall Site that house the joints between the offshore cables and the onshore cables.

Terms and abbreviations specific to this technical chapter contained herein are provided at the end of the document in the **Topic Glossary and Abbreviations.**

18 MARINE PHYSICAL ENVIRONMENT

18.1 Introduction

18.1.1 This chapter provides a preliminary assessment of the potential likely significant effects in relation to the marine physical environment from the construction, operation and maintenance, and decommissioning of LionLink (here after referred to as 'the Proposed Scheme').

18.1.2 This chapter outlines legislation, policy and guidance that is relevant to the marine physical environment, summarises the engagement undertaken to date, sets out the scope and methodology of assessment, and describes the baseline environment. Following this, the likely significant effects of the Proposed Scheme on the marine physical environment are assessed taking account of mitigation measures within the design. The need for any additional mitigation is then considered along with any proposals for monitoring and/or enhancement. The chapter concludes with a summary of residual effects.

18.1.3 The marine physical environment aspects considered within this chapter for the Proposed Scheme are:

a. seabed morphology
b. coastal morphology
c. seabed substrates
d. sediment quality
e. water quality

18.1.4 This chapter should be read in conjunction with **Chapter 2 Description of the Proposed Scheme** of this PEIR, which describes the development parameters against which the effects considered in this chapter have been assessed, and **Chapter 5 EIA Approach and Methodology** of this PEIR where the project-wide approach to the assessment methodology is set out.

18.1.5 In addition, there may be interrelationships related to the potential effects on the marine physical environment and other disciplines. Therefore, this chapter should be read alongside relevant parts of other chapters; namely:

a. **Chapter 19 Intertidal and Subtidal Benthic Ecology** of this PEIR;
b. **Chapter 20 Fish and Shellfish** of this PEIR;
c. **Chapter 21 Intertidal and Offshore Ornithology** of this PEIR; and
d. **Chapter 22 Marine Mammals** of this PEIR.

18.1.6 This chapter is supported by the following appendices and figures, contained within Volume 2 and Volume 3 of this PEIR, respectively:

a. **Appendix 29.1 Outline Schedule of Environmental Commitments and Measures** of this PEIR;
b. **Appendix 2.5 Outline Cable Burial Risk Assessment** of this PEIR;

c. **Appendix 4.1 Legislation and Policy Register** of this PEIR;
d. **Appendix 4.2 Marine Plan Assessment** of this PEIR;
e. **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR
f. **Appendix 18.2 Proposed Offshore Scheme Water Framework Directive Assessment** of this PEIR; and
g. **Figure 18.1** to **18.13** of this PEIR.

18.1.7 As set out in **Chapter 4 Policy & Legislation** of this PEIR, cable installation and some associated activities beyond 12 nautical miles (NM) are exempt under the Marine and Coastal Access Act 2009 (MCAA) as well as repair of the installed cable. This chapter presents a preliminary assessment of the Proposed Offshore Scheme from mean high water springs (MHWS) at the proposed Landfall to the boundary between the UK and Netherlands Exclusive Economic Zones (EEZ), including all exempt activities which would not be consented as part of the Development Consent Order (DCO). This is to provide a complete and holistic view of the Proposed Offshore Scheme and any associated impacts. Beyond 12NM, only cable protection and dredging for sandwave levelling will be included in the Deemed Marine Licence (DML).

18.2 Legislation and policy framework

18.2.1 This section identifies the legislation, policy and guidance that has informed the assessment of the likely significant effects on the marine physical environment.

18.2.2 The legislation and planning policy which has informed the assessment of effects with respect to the marine physical environment is provided within **Appendix 4.1 Legislation and Policy Register** of this PEIR. A preliminary marine plan assessment is provided as **Appendix 4.2 Marine Plan Assessment** of this PEIR.

18.2.3 **Table 18.1** lists the legislation relevant to the assessment of the likely significant effects on the marine physical environment.

Table 18.1: List of relevant legislation for the marine physical environment assessment

Legislation	Relevance to assessment
Marine Strategy Regulations 2010 (MSFD) (Ref 1).	These regulations require the UK to achieve or maintain Good Environmental Status in its marine waters by 2020. The high-level descriptors of Good Environmental Status relevant to marine processes include: • Descriptor 6: Sea floor integrity: Seafloor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded, and benthic ecosystems are not adversely affected; and • Descriptor 7: Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems
The Planning Act 2008 (Ref 2)	This Act establishes the Infrastructure Planning Commission and makes provision about its functions; to make provision about, and

Legislation	Relevance to assessment
	about matters ancillary to, the authorisation of projects for the development of nationally significant infrastructure.
The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Ref 3)	This Act transposes EU Directive 2011/92/EU (the EIA Directive) into UK law for nationally significant infrastructure projects, ensuring environmental safeguards while potentially streamlining the process.
Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) (Ref 4)	The Marine Works (Environmental Impact Assessment) Regulations 2007 require certain types of projects that have the potential to significantly affect the environment to submit an Environmental Impact Assessment (EIA) before a marine licence decision is made.
Marine and Coastal Access Act 2009 (Ref 5)	The MCAA provides a framework for managing and protecting marine and coastal areas, promoting sustainable development, enhancing public access to the coast, and conserving marine biodiversity and habitats, including establishing marine protected areas and coastal access routes

National policy

18.2.4 The primary policy basis for deciding whether to grant a Development Consent Order (DCO) for the Proposed Scheme are the National Policy Statements (NPSs), and of primary relevance the Overarching NPS for Energy (NPS EN-1) (Ref 6), the NPS for Renewable Energy Infrastructure (NPS EN-3) (Ref 7) and the UK Marine Policy Statement (Ref 8). These set out policies to guide how applications for development consent for energy infrastructure should be decided and how the effects of such infrastructure are considered.

18.2.5 **Table 18.2** lists the paragraphs from the NPS and other national policy that are relevant to the marine physical environment assessment. It also sets out where these policy requirements are addressed within the chapter.

Table 18.2: List of relevant national policy for the marine physical environment assessment

Relevant paragraph reference	Summary of policy requirement	Where addressed in PEIR
NPS EN-1		
5.6.10	*"Where relevant, applicants should undertake coastal geomorphological and sediment transfer modelling to predict and understand impacts and help identify relevant mitigating or compensatory measures."*	Plume dispersion modelling has been undertaken to predict and understand the impacts of sediment disturbance from the Proposed Scheme. Results from the modelling are discussed in **Section 18.8** and **Appendix 18.1**

Relevant paragraph reference	Summary of policy requirement	Where addressed in PEIR
		Sediment Dispersion Modelling of this PEIR.
5.6.11	*"• the impact of the proposed project on coastal processes and geomorphology, including by taking account of potential impacts from climate change. If the development will have an impact on coastal processes the applicant must demonstrate how the impacts will be managed to minimise adverse impacts on other parts of the coast; and • the implications of the proposed project on strategies for managing the coast as set out in SMPs (which are designed to identify the most sustainable approach to managing flood and coastal erosion risks from short to long term and are long term non-statutory plans which set out the agreed high-level objective for coastal flooding and erosion management for each SMP area), any relevant Marine Plans, River Basin Management Plans, and capital programmes for maintaining flood and coastal defences and Coastal Change Management Areas"*	The baseline understanding considers the future baseline conditions with appropriate climate change allowance (**Section 18.6, paragraphs 18.6.61** to **18.6.71**). The Proposed Scheme is not expected to impact coastal processes. The Proposed Scheme is not expected to have any implications on strategies for managing the coast (see **paragraph 18.8.45**).
NPS EN-3		
2.8.267	identifies the potential for direct effects on the physical environment to result in indirect effects on a number of other receptors and highlights that any such indirect effects should take account of relevant sections of NPS EN-1 and NPS EN-3.	The potential for direct effects on the physical environment to result in indirect effects on the physical environment are assessed within this chapter of this PEIR. Relevant chapters within this PEIR consider the potential for indirect effects on other receptors.
2.8.309	Makes specific reference to wind farm design, but the text is largely relevant to the Proposed Scheme. The NPS identifies a requirement to satisfy the Secretary of State that the design of (the wind farm), offshore transmission and methods of construction, including use of materials, are such as to reasonably minimise the potential for impact on the physical environment. This could involve, for instance, minimising quantities of rock that are used to protect cables whilst	The amount of cable protection is minimised by cable burial where feasible. Areas expected to require cable protection are quantified in **paragraphs 18.8.18** and **18.8.19.**

Relevant paragraph reference	Summary of policy requirement	Where addressed in PEIR
	taking into account other relevant considerations such as safety.	
UK Marine Policy Statement		
Paragraph 2.6.7	Relates to climate change adaptation and mitigation. There is a requirement on marine plan authorities to encourage developments to take account of the impacts of climate change (including sea level rise and possible increase in risk from extreme events such as flooding and coastal erosion) over their expected lifetime.	The baseline understanding considers the future baseline conditions with appropriate climate change allowance (**Section 18.6, paragraphs 18.6.61** to **18.6.71**).
Paragraph 2.6.8	Relates to coastal change and flooding, which are likely to be exacerbated by climate change. Marine plan authorities should be satisfied that activities and developments will themselves be resilient to risks of coastal change and flooding and will not have an unacceptable impact on coastal change. Coastal change from both direct and indirect (for example from interruption or changes to the supply of sediment due to infrastructure) should be considered.	An assessment of the impact of the Proposed Scheme on coastal change is provided in **Section 18.8, paragraph 18.8.5** and **18.8.48.**

18.2.6 The local policies listed in **Table 18.3** are considered relevant to the marine physical environment assessment of the Proposed Scheme.

Table 18.3: List of relevant local policy for the marine physical environment assessment

Local planning authority	Relevant local policy	Relevance to assessment
Marine Management Organisation (MMO)	East Inshore and East Offshore Marine Plans (Ref 9)	Marine plans set out the priorities and direction for future planning within the plan area and provide guidance on activities to avoid or promote. **Appendix 4.2 Marine Plan Assessment** of this PEIR outlines how the Proposed Offshore Scheme complies with the policies and objectives for the East Inshore and East Offshore Marine Plan area.

18.3 Consultation and engagement

18.3.1 This section describes the outcome of, and response to EIA Scoping Report (Ref 10) and the EIA Scoping Opinion (Ref 11)in relation to the marine physical environment assessment.

18.3.2 It also provides details of the ongoing technical engagement that has been undertaken with key stakeholders and provides a brief overview of the non-statutory public consultation undertaken to date.

18.3.3 Feedback from engagement and consultation are used to define the assessment approach and to ensure that appropriate baseline information is used.

18.3.4 It should be noted that feedback is also used to drive the design of the Proposed Scheme to avoid, prevent and reduce any likely environmental effects. **Chapter 3 Alternatives and Design Evolution** of this PEIR reports how the Proposed Scheme design has evolved in response to feedback and details of proposed embedded design (Primary) mitigation and standard good practice (Tertiary) mitigation measures relevant to the marine physical environment assessment are provided in **Section 18.7** of this chapter.

Consultation

Non-Statutory consultation

18.3.5 Feedback received from stakeholders following the close of our 2022 and 2023 consultation is outlined within the **Interim Non-Statutory Consultation Feedback Summary Report 2023** (Ref 12) and **Supplementary Non-Statutory Consultation Summary Report 2024** (Ref 13).

18.3.6 **Table 18.4** below includes a summary of key Non-Statutory consultation feedback received to date and how this has been addressed within the PEIR or will be addressed within the ES.

Table 18.4: Key non statutory consultation feedback for marine physical environment assessment

Stakeholder	Comment	Applicant response
East Suffolk Council	Highlighted that coastal change and the geomorphological impacts of the Landfall need to be carefully considered in addition to any potential interference with strategic coastal management. Concern was raised regarding long-term trends of beach recession and cliff erosion and whether the design of the Proposed Scheme takes this into consideration. A thorough assessment of coastal change must be provided. A key document would be the Shoreline Management Plan 7. The site also	Horizontal Directional Drilling (HDD) (Trenchless cabling technique) would be used at the proposed Landfall with ducts expected to be at depths of more than 20m below the surface. Additional details on long-term trends of beach recession and coastal change are provided in **Section 18.8, paragraphs 18.8.45** to **18.8.47.**

Stakeholder	Comment	Applicant response
	lies within ESC's Coastal Change Management Area which should be carefully considered. There are no existing hard defences at the Landfall site and no plans to provide them.	
Eastern Inshore Fisheries and Conservation Authority	Recommended that consideration is given to reducing the number of trenches, ensuring that backfill material is original material rather than imported, and that design reduces the scope for any scour impacts or cable exposure	As per the design and embedded mitigation measures (**Table 18.15**), all HVDC Submarine Cables would be installed in one trench (Commitment Reference OD01) and sediment displaced for exit pits and cable installation (sandwave clearance and trenching) would be side cast/locally placed to enable the original material to be reused for backfill (Commitment Reference OD10).
Members of the Public	Raised concerns regarding sea level rise and coastal erosion along the Suffolk coastline and whether the Proposed Scheme would exacerbate coastal erosion or prohibit future coastal management practices.	The Proposed Scheme would not be expected to alter the sediment transport pathways and therefore would not exacerbate coastal erosion. An assessment of the potential for cable exposure due to coastal erosion has been undertaken in **Section 18.8, paragraphs 18.8.45** to **18.8.51.** As the risk is assessed as low the Proposed Scheme would not be expected to prohibit future coastal management practices.

EIA Scoping Opinion

18.3.7 An EIA Scoping Opinion was adopted by the Planning Inspectorate on behalf of the Secretary of State on 16 April 2024 (Ref 11). The Applicant received a separate EIA Scoping Opinion from the MMO (Ref 14) as the MMO were unable to provide opinion to the Planning Inspectorate in time for the April 2024 deadline. MMO deferred to Natural England's comments received by the Planning Inspectorate with respect to the suitability of the assessment with regards to Marine Protected Areas.

18.3.8 Comments received from the Planning Inspectorate and MMO in relation to the marine physical environment are provided in **Table 18.5**.

Table 18.5 Preliminary response to Planning Inspectorate and MMO Scoping Opinion comments for marine physical environment

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
Planning Inspectorate	Given the uncertainty in the route and requirement for a	Since Scoping, the Walberswick landfall location has been selected, and construction

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
ID 3.13.1	cofferdam is unknown the potential for changes to coastal morphology during construction cannot be scoped out.	methods have been refined. No cofferdam would be required for the proposed Landfall enabling works. However, as requested the potential for changes to coastal morphology during construction has been scoped in. The assessment scope is defined **Table 18.7** and the assessment of impact on coastal morphology during construction is provided in **paragraphs 18.8.3** to **18.8.5.**
Planning Inspectorate ID 3.13.3	Potential for contaminants/nutrients to be present is not fully understood and the inspectorate does not agree that this matter can be scoped out at this stage.	Information on sediment quality from samples collected as part of the marine characterisation surveys has been analysed to assess potential for suspension of contaminated sediments during construction. The sampling included analysis of total organic carbon (TOC) and total organic matter (TOM), which represent the proportion of biological material and organic detritus in the sediment and can provide a valuable primary indicator of the potential for nutrient cycling and availability within seabed sediments. No other nutrient sediment sample data has been identified in the study area, but nutrient levels in water samples collected by the Environment Agency (Ref 15) have been assessed. Baseline information on contaminants is provided in **Section 18.6, paragraph 18.6.47** to **18.6.57.**
Planning Inspectorate ID 3.13.4	The ES should identify whether the Proposed Development has the potential for significant transboundary effects.	Numerical modelling of sediment dispersion has been undertaken and is provided in **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR. The results have been used to inform the potential for transboundary effects. Results are discussed in **Section 18.8, paragraph 18.8.37** to **18.8.38.**
Planning Inspectorate ID 3.13.5	Changes from release of drilling fluids can be scoped out of the assessment on the basis that the monitoring, and any subsequent mitigation measures required to avoid a likely significant effect are fully described in the ES.	**Section 18.7** describes the control measures that would be implemented to manage drilling fluids. Several management plans would be provided as Outline Management Plans with the application for development consent to support the deemed Marine Licence. These would include an Outline Offshore Construction Environmental

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
		Management Plan (CEMP) and an Outline Marine Pollution Contingency Plan. The Outline Offshore CEMP is provided as **Appendix 2.2** of this PEIR. These documents would outline measures to be implemented to comply with legislation (e.g., in relation to the prevention of chemical spills).
Planning Inspectorate ID 3.13.6	Changes to sediment quality and water quality from accidental spills can be scoped out. The ES should identify and ensure that mitigation for all potential pollution incidents is accounted for in the Marine Pollution Contingency Plan (MPCP). The ES should explain where appropriate management and control measures to reduce/avoid potential pollution events are secured through the DCO or other legal mechanism.	**Section 18.7** describes the control measures that would be implemented to manage oil and chemical spills. Several management plans would be provided as Outline Management Plans with the application for development consent to support the deemed Marine Licence. These would include an Outline Offshore CEMP and an Outline Marine Pollution Contingency Plan. The Outline Offshore CEMP is provided as **Appendix 2.2** of this PEIR. These documents would outline measures to be implemented to comply with legislation and would be secured through the DCO.
Planning Inspectorate ID 3.13.7	Changes to sediment quality from temperature increase during operation cannot be scoped out in the absence of the Cable Risk Burial Assessment (CBRA)	**Appendix 2.5 Outline Cable Burial Risk Assessment** of this PEIR presents the conclusions of a desk-based CBRA, which recommends a minimum Depth of Lowering (DoL) of 0.6m along the Proposed Offshore Scheme. The assessment will be refined in the ES based on the Preliminary CBRA which would incorporate the site specific geotechnical and geophysical survey data. An assessment of potential temperature increases during operation has been undertaken and is provided in **Appendix 2.4 Offshore Thermal Emissions Technical Note** of this PEIR. This impact pathway has been scoped in and is assessed in **Section 18.8, paragraphs 18.8.63 to 18.8.67.**
Planning Inspectorate ID 3.13.8	The ES should clearly define the study area based on the Zone of Influence (Zol), together with a robust justification for its final extent.	Numerical modelling tools developed to assess fine sediment dispersion during construction have been applied to justify the extent of the study area. Results from the numerical modelling are presented in **Appendix 18.1 Sediment Dispersion**

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
		Modelling of this PEIR and summarised in **Section 18.8, paragraph 18.8.24.**
Planning Inspectorate ID 3.13.9	The shoreline sediment transportation description in the pion Report is not accurate in all areas.	A more detailed description of the sediment transport pathways is provided based on technical studies undertaken by the Applicant and information presented in the Shoreline Management Plans for the region. This is addressed in **Section 18.6, paragraph 18.6.7.**
Planning Inspectorate ID 3.13.10	The ES should include up to date information in respect of areas of shoreline management.	The Shoreline Management Plan (SMP) Explorer website has been added to the list of data sources and information was reviewed to ensure the shoreline management strategy was accurate. This is addressed in **Section 18.6, paragraph 18.6.13.**
Planning Inspectorate ID 3.13.11	A figure should be provided to illustrate the location of designated bathing waters in relation to the study area.	Bathing water locations have been added to **Figure 18.12** of this PEIR.
Planning Inspectorate ID 3.13.12	The Centre for Environment, Fisheries and Aquaculture Science (Cefas) action levels are not explained in the context of the rationale presented. Monitoring and grab sampling locations should be shown on a plan.	Explanation on Cefas Action Levels has been included in **Section 18.6, paragraph 18.6.50** and a figure showing the monitoring and grab sampling locations is provided as **Figure 18.11** of this PEIR.
Planning Inspectorate ID 3.13.13	The EIA Scoping Report contains errors in the list of sites and qualifying/interest.	The list of sites has been reviewed and updated. This is addressed in **Section 18.6, paragraph 18.6.58** to **18.6.60.**
Planning Inspectorate ID 3.13.14	The description of the coastline receptor is vague.	The term coastal morphology has been adopted instead. Addressed throughout.
Planning Inspectorate ID 3.13.15	Detail on the condition of the structure at the mouth of the River Blyth should be provided.	Information on the condition of the Southwold Harbour Training Arms is provided in **Section 18.8, paragraph 18.6.9**.
Planning Inspectorate ID 3.13.16	Coastal morphology during operation should be scoped into the assessment or the ES should demonstrate the absence of likely significant effects.	Disturbance of coastal morphology during operation and maintenance has been scoped in. This is addressed in **Section 18.8, paragraph 18.8.48.**

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
Planning Inspectorate ID 3.13.17	Additional sources of data should be included in the assessment including the Anglian Regional Coastal Monitoring Programmes (ARCMP) open source data.	Data from ARCMP has been reviewed as part of the technical studies undertaken by the Applicant. The relevant information is referenced in **Section 18.6, paragraph 18.6.10.**
Planning Inspectorate ID 3.13.18	The ES should either be based on updated numerical modelling covering the area affected by the Proposed Development or give a justification as to why use of the existing modelling provides a robust approach.	A numerical modelling assessment has been undertaken. Results from the modelling are discussed in **Section 18.8** and **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR.
MMO Paragraph 3.2.1	In Table 18.4 of the EIA Scoping Report, changes to Coastal Morphology are scoped out. The MMO agrees with this. However, impacts of changes in coastal morphology on the cable (the reverse) should be scoped in. This is because both potential landing sites experience significant coastal change. Furthermore, for increase in suspended sediments, whilst for a single, isolated cable the MMO would agree to be scoped out. However, for a potentially realistic scenario of multiple activities (multiple cables, Sizewell, and dredging) increasing suspended sediment concentration (i.e. the cumulative impact) needs assessing. Thus, this should be scoped in.	The impacts of changes in coastal morphology on the cable has been assessed in **Section 18.8, paragraph 18.8.45** to **18.8.47.** An assessment of the increase in SSC associated with cable installation is provided in **Section 18.8, paragraph 18.8.21** to **18.8.36,** with additional information provided in **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR. The assessment of cumulative effects will be presented in the ES.
MMO Paragraph 3.2.2	**Section 18.5** states that: “sediments in areas where pre-sweeping is proposed will be tested to ensure compliance with Cefas Action Levels for disposal in line with MMO sampling plan requirements.” An indication of the anticipated	Anticipated worst-case volumes of sediment which would be removed during sandwave clearance is provided in **Section 18.8, paragraph 18.8.8.**

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
	worst-case scenario volumes of material which would be removed during sandwave clearance should be included.	
MMO Paragraph 3.2.3	Impacts scoped out include; Temporary increase in suspended sediments and subsequent deposition, from seabed preparation other than pre-sweeping, cable burial, repair and removal. While the MMO agrees with this, as the vast majority of potential sediment disturbance will likely be from the named activities, it should be noted that without knowing the contaminant potential of the sediments, such a scoping decision carries residual risk	Information on sediment quality from samples collected as part of the marine characterisation survey has been analysed to assess potential for suspension of contaminated sediments during construction. Baseline information on contaminants is provided in **Section 18.6, paragraphs 18.6.47** to **18.6.57.**
MMO Paragraph 3.2.4	Another impact scoped out is the release of drilling fluids. The MMO consider that this pathway should be scoped in rather than scoped out. The release of drilling fluids cannot be assessed without knowing the properties of the potential fluids to be used.	Where practicable, drilling fluids that are Cefas registered and are PLONOR would be used. Technical studies undertaken by the Applicant indicate a maximum drilling fluid loss of 2,500m^3 per HDD with a maximum daily loss of less than 300m^3 (Ref 16). On this basis we propose to scope out release of drilling fluids from the assessment.
EA	A total area of impact needs to be estimated, with all sediment disturbance activity is factored in (trenching technique and sediment plume).	Predicted areas of impact associated with sediment disturbance have been quantified. This is addressed in **Section 18.8,** and **Table 15** to **Table 18** in **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR**.**
Office for Nuclear Regulation (ONR)	The effect of offshore construction activities on the external hazard to the Sizewell nuclear licensed sites (increased levels of material in suspension in the sea water) should be assessed.	A numerical model has been developed and applied to assess potential for increases in suspended sediment concentrations (SSCs) at the Sizewell B (and planned Sizewell C) intake(s). This is addressed in **Section 18.8, paragraphs 18.8.34** and **18.8.55** with additional detail provided in **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR.

Engagement

18.3.9 This section provides details of the ongoing technical engagement that has been undertaken with stakeholders in relation to marine physical environment and is outlined below.

Key stakeholders

18.3.10 Key stakeholders with views and concerns regarding marine physical environment have been identified as including:

a. Cefas;
b. Joint Nature Conservation Committee (JNCC);
c. Natural England;
d. Suffolk Wildlife Trust (SWT);
e. Office for Nuclear Regulation (ONR);
f. EDF Energy (Sizewell B and C);
g. MMO; and
h. Suffolk County Council.

18.3.11 Technical engagement with the key stakeholders is ongoing. A summary of the technical engagement undertaken since 2022 is outlined in **Table 18.6**.

Table 18.6: Key stakeholder feedback for the marine physical environment

Stakeholder	Comment	Applicant response
Cefas	Rates of sandwave migration should be estimated from areas where data allows.	Sandwave migration rates are presented in **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR and also quoted in **Section 18.8, paragraph 18.8.11.**
Cefas	Consideration should be given to impact of surges, which are present along the Suffolk coast.	Discussion of the effects of surges is provided in **Section 18.6, paragraph 18.6.29.**
Cefas/MMO	Due to the proximity of Sizewell C (a Nationally Important Structure), modelling needs to reference background concentrations in assessment of project impacts. Fine sediments and chalk are most noteworthy for their extended residence time in suspension.	A numerical model has been developed and applied to assess potential for increases in SSCs at the Sizewell B (and planned Sizewell C) intake(s). Results are presented in **Section 18.8, paragraph 18.8.34** and **paragraph 18.8.55,** with additional detail provided in **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR.
MMO	MMO have asked their dredging team to confirm whether contaminated sediment modelling is required	Sediment samples collected from the Draft Order Limits were analysed for contaminants. All contaminants were at concentrations below Cefas Action Level 2 and are therefore deemed

Stakeholder	Comment	Applicant response
		suitable for placement at sea (see **Section 18.6, paragraphs 18.6.47** to **18.6.57.).**
JNCC	Presentation of distances of dispersion for suspended sediment concentrations are of interest.	These are included in **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR.
JNCC	Proximity of bed preparation (pre-sweeping) and the North Norfolk Sandbank are of interest	The potential for impacts at the North Norfolk Sandbank from pre-sweeping is assessed in **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR.
JNCC	Cable Burial Risk Assessment should include justification for use of rock protection.	The Cable Burial Risk Assessment (CBRA) is a technical risk-based assessment that determines the depth the HVDC Submarine Cables should be buried at to protect them from external aggressors e.g., anchor strike, fishing activity. A Burial Assessment Study (BAS) is typically completed after the CBRA to determine whether the installation tools available on the market can bury the HVDC Submarine Cables to the required depth taking site specific seabed conditions into consideration. If seabed conditions do not allow for the necessary depth of burial as outlined in the CBRA, the BAS determines the level of cable protection required e.g. rock, concrete mattresses or other means as described in **Chapter 2 Description of the Proposed Scheme** of this PEIR. The location of remedial cable protection was not known for the PEIR and therefore a precautionary approach has been taken, and it is assumed that it could be used anywhere within the Proposed Scheme.
Sizewell C	There is a small possibility of cable maintenance resulting in suspended sediment posing an issue at the Sizewell C intakes although this is considered unlikely. The actual mass of sediment entering the intakes and the properties (particle size) of sediment reaching the intakes would be of interest.	Numerical modelling has been used to predict suspended sediment concentrations and sedimentation from cable installation. The assessment of the potential impact from the modelling results is provided in **Section 18.8, paragraph 18.8.55.** Given that only clay sized fractions would reach the intake and given that such fine sediment would be expected to remain in suspension

Stakeholder	Comment	Applicant response
		within the cooling water system, no estimates of sediment mass have been included.
Sizewell C	Concern raised about potential risk of coastal erosion at Sizewell C.	There is no temporary or permanent infrastructure in the coastal zone which would affect longshore sediment transport pathways.

18.4 Assessment methodology

18.4.1 This section outlines the methodology followed to assess the potential likely significant effects of the Proposed Scheme in relation to the marine physical environment including:

a. effects scoped into the assessment;
b. study area;
c. assessment scenarios;
d. methodology;
e. assessment criteria; and
f. assessment of cumulative effects.

18.4.2 This section provides a description of how receptor sensitivity, magnitude of impact and significance of effects are all described and assigned to the assessment.

18.4.3 The project-wide approach to the assessment methodology is set out in **Chapter 5 EIA Approach and Methodology** of this PEIR.

Scope of the assessment

18.4.4 Physical processes are best described as pathways, rather than as receptors. While outputs from the marine physical environment assessments will be reported in a stand-alone ES chapter, for the most part it is not practical for them to be accompanied by statements of effect of significance. Instead, the information on changes to the physical processes' pathways will be used to inform other EIA topic assessments including:

a. **Chapter 20 Fish and Shellfish** of this PEIR;
b. **Chapter 21 Intertidal and Offshore Ornithology** of this PEIR;
c. **Chapter 22 Marine Mammals** of this PEIR;
d. **Chapter 24 Commercial Fisheries** of this PEIR; and
e. **Chapter 26 Marine Archaeology** of this PEIR.

18.4.5 The significance of indirect impacts from the identified physical processes pathways would be assessed within the relevant topics.

18.4.6 Potential likely significant effects requiring assessment may be temporary or permanent and may occur during construction, operation and maintenance, and decommissioning. Potential likely significant effects on marine physical environment receptors within the scope of the assessment are summarised in **Table 18.7**. The scope of the assessment has responded to feedback received as detailed in **Section 18.3**.

Table 18.7: Summary of the scope for marine physical environment assessment

Receptor	Construction	Operation and maintenance	Decommissioning
Coastal morphology	Changes to coastal morphology	Changes to coastal morphology - Impact of future coastal erosion on the Proposed Scheme	-
Seabed morphology	Temporary habitat loss/ seabed disturbance	Temporary habitat loss/ seabed disturbance	Temporary habitat loss/ seabed disturbance
Water quality Seabed substrates	Temporary increase in suspended sediment concentrations (SSC) and subsequent deposition	Temporary increase in suspended sediment concentrations (SSC) and subsequent deposition	Temporary increase in suspended sediment concentrations (SSC) and subsequent deposition
Seabed substrates/ geology	Permanent habitat loss	Permanent habitat loss	-
Water quality Seabed substrates	Transboundary Impacts – Temporary increases in SSC and subsequent deposition	Transboundary Impacts – Temporary increases in SSC and subsequent deposition	Transboundary Impacts – Temporary increases in SSC and subsequent deposition
Sediment quality	-	Temperature increase	-
Sediment quality/water quality	Release of contaminated sediment	-	-

Study area

18.4.7 This section describes the spatial scope (the area which may be impacted) for the assessment as it applies to the marine physical environment.

18.4.8 The spatial scope of the impact assessment for marine physical environment covers the area of the Proposed Offshore Scheme contained within the Draft Order Limits, together with the study area, described as follows.

18.4.9 The Proposed Offshore Scheme routes from Walberswick across the Southern North Sea to the boundary between the English and Dutch EEZ. The Draft Order Limits for the Proposed Offshore Scheme is illustrated in **Figure 18.1** of this PEIR.

18.4.10 The study area used for this assessment is defined as a 15km buffer around the Draft Order Limits. This buffer is based on local tidal excursion distances, which varies along the Proposed Offshore Scheme.

18.4.11 The study area was verified against the predicted Zone of Influence from a modelling assessment of fine sediment disturbance (**Appendix 18.1 Sediment Dispersion Modelling** of this PEIR).

Assessment scenarios

18.4.12 **Chapter 5 EIA Approach and Methodology** of this PEIR, provides an overview of the project's approach to the temporal scope (the time scales over which impacts may occur) of the EIA. This section describes the temporal scope for the assessment as it applies to the marine physical environment.

18.4.13 The temporal scope has been informed by **Chapter 2 Description of the Proposed Scheme** of this PEIR. The temporal scope of the assessment of marine physical environment is consistent with the period over which the Proposed Offshore Scheme would be carried out. It covers the period from award of consent to the anticipated end of the Proposed Scheme lifespan.

18.4.14 It assumes construction of the Proposed Offshore Scheme would commence at the earliest 2028 and complete by 2032. Operation would commence in 2032 with periodical maintenance required during the operational phase of the Proposed Offshore Scheme. It is assumed that maintenance and repair activities could take place at any time during the life span of the Proposed Offshore Scheme.

18.4.15 It is during the construction phase of the Proposed Offshore Scheme that direct impacts to marine physical environment receptors are most likely to occur. Indirect impacts may also occur during construction-related activities.

18.4.16 The Proposed Offshore Scheme would be licensed for 40 years. At this point, either an extension to the licence would be requested, supported by the necessary environmental assessment, or decommissioning would take place. If decommissioning is required, then activities and effects associated with the decommissioning phase are expected to be of a similar level to those during the construction phase works, albeit with a lesser duration of two years, and with the removal of visible infrastructure, effects would reduce over the course of that period.

18.4.17 Acknowledging the complexities of completing a detailed assessment for decommissioning works 40 years in the future, based on the information available, the Applicant has concluded that impacts from decommissioning would be no greater than those during the construction phase. Furthermore, should decommissioning take place, it is expected that a full assessment in accordance with the legislation and guidance at the time of decommissioning would be undertaken. In addition, it expected that the DCO would include a requirement for

a written scheme of decommissioning for approval by the MMO and in line with The Crown Estate requirements.

Baseline methodology

Data collection

18.4.18 Baseline data collection has been undertaken to obtain information over the study area. This section provides the approach to collecting baseline data.

18.4.19 The following sources of data have been utilised to inform the baseline with respect to the marine physical environment.

Table 18.8: Data sources used to inform the marine physical environment assessment

Source of data	Baseline data
UK Renewables Atlas (Ref 17)	Maps of annual wave heights, wind speeds, tidal range (spring and neap), peak tidal flows (spring and neap) and mean tide tidal ellipse. Provides full coverage of study area.
National Tide and Sea Level Facility (NTSLF) (Ref 18)	Water level timeseries at Lowestoft. Provides data at a single discrete location.
Admiralty TotalTide (ATT) (Ref 19)	Tide level predictions from Admiralty tide tables and tidal flow predictions at tidal diamonds. Provides data at discrete locations within the study area.
British Oceanographic Data Centre (BODC) (Ref 20)	Measured historical flow data. Provides data at discrete locations within the study area.
Hybrid Coordinate Ocean Model (HYCOM) GOFS3.1 (Ref 21)	22-year reanalysis of currents at 1/24 resolution – includes tidal and non-tidal (referred to as residual) flows. Provides full coverage of study area.
Channel Coastal Observatory (CCO) (Ref 22)	Wave data from Lowestoft Wave Buoy (2016 to present) and Met Station data from Southwold (2020 to present). Provides data at discrete locations within the study area.
ARCMP (Ref 23)	Beach profile data from the ARCMP was reviewed as part of technical studies undertaken by the Applicant to inform shoreline changes at the proposed Landfall.
SEASTATES wave hindcast model (Ref 24)	Modelled hindcast wind and wave data. Provides full coverage of study area.
Climate System Forecast Reanalysis (CFSR) (Ref 25)	Hindcast wind data at 0.5 degree resolution, spanning 43 years (1979 to 2022). Provides full coverage of study area.

Source of data	Baseline data
WaveWatch III (WW3) (Ref 26)	30-year wave hindcast, 3 hourly combined wind waves and swell on 4-minute model grid. Provides full coverage of study area.
British Geological Society (BGS) (Ref 27)	Seabed sediment maps and borehole records. Provides data at discrete locations within the study area.
One Benthic (Ref 28)	Particle Size Distribution (PSD) from grab samples at discrete locations within the study area.
Admiralty Marine Data Portal (Ref 29)	Bathymetric survey data. Provides partial coverage of the study area.
The European Marine Observation and Data Network (EMODnet) (Ref 30	Digitised and interpolated bathymetry and seabed sediment layer. Provides full coverage of study area.
UK Hydrographic Office (UKHO)	Navigation charts. Provides full coverage of study area.
Cefas (Ref 31)	Monthly and seasonal maps of Suspended Particulate Matter (SPM). Provides full coverage of study area.
Shoreline Management Plan – SMP7 (Ref 32)	Local annual surveys of coastline. Provides full coverage of the coastal areas within the study area.
UK climate change projections 2018 (Ref 33)	Sea level rise predictions along the coast. Provides full coverage along the coastline within the study area.
East Anglia One EIA and supporting studies (Ref 34)	Review of baseline characterisation data. Provides partial coverage of the study area.
East Anglia Two EIA and supporting studies (Ref 35)	Review of baseline characterisation data. Provides partial coverage of the study area.
East Anglia Three EIA and supporting studies (Ref 36)	Review of baseline characterisation data. Provides partial coverage of the study area.
Norfolk Boreas EIA and supporting studies (Ref 37)	Review of baseline characterisation data. Provides partial coverage of the study area.
Norfolk Vanguard EIA and supporting studies (Ref 38)	Review of baseline characterisation data. Provides partial coverage of the study area.
Clean Safe Seas Environmental Monitoring Programme (CSEMP) (Ref 39)	Sediment quality data. Provides data at discrete locations within the study area.
Open WIMS (Ref 1)	Water quality archive of Environment Agency water quality sample data: Provides data at discrete locations within the study area.
MAGIC mapping managed by Natural England (Ref 40)	Geographical mapping of the natural environment from sources including Defra, Natural England, the Environment Agency and

Source of data	Baseline data
	the Marine Management Organisation (MMO). Provides full coverage of study area.

Site surveys

18.4.20 The baseline site surveys undertaken for the marine physical environment were:

a. Geophysical survey – multi-beam echosounder (MBES), side scan sonar (SSS), magnetometer and sub-bottom profiler (SBP);
b. Geotechnical survey – cone penetrometer tests (CPT) and vibrocore; and
c. Environmental survey – drop down video, grab sampling.

18.4.21 Marine characterisation surveys consisting of geophysical, geotechnical and environmental survey techniques were undertaken by Next GeoSolutions on a nominal 500m wide corridor between May 2024 and February 2025. The area of seabed surveyed by the marine characterisation survey has been taken forward as the extent of the Draft Order Limits. Survey scopes were agreed with Cefas, JNCC and Natural England prior to commencing work. A summary of the survey geophysical and geotechnical specifications is provided in **Table 18.9**. The environmental survey is described in **Chapter 19 Intertidal and Subtidal Benthic Ecology** of this PEIR.

18.4.22 The objectives of the geophysical survey were to:

a. Map the subtidal seabed and sub-surface to optimise cable routeing within the Order Limits and to enable assessment of cable burial depth;
b. Identify locations where sandwave pre-sweeping was anticipated;
c. Plan the scope and position of the geotechnical and environmental sampling programme (with additional sampling planned in areas where sandwave pre-sweeping was anticipated);
d. Identify marine habitat areas for the benthic survey;
e. Identify sensitive marine habitats which would need to be avoided during geotechnical and environmental sampling and construction; and
f. Provide the geophysical data from which a marine archaeological assessment could be undertaken as part of the future consenting process.

18.4.23 To meet these objectives, the geophysical survey undertook the following:

a. Measured intertidal topography and seabed bathymetry and surface morphology and identified the nature of the seabed sediments - in particular the height, length and slopes of bedforms using MBES and SSS;
b. Identified the distribution and thickness of superficial sediments and rock head using SBP;
c. Identified the distribution of subsea geological features such as areas of exposed bedrock using MBES and SSS;
d. Identified the location, extent and nature of any impediments to laying or burial of the cables such as wrecks, debris on seafloor, rock outcrop, other cables, pipelines etc. Survey techniques deployed to meet this objective included magnetometer, MBES and SSS; and

e. Used a remotely operated vehicle at infrastructure crossings (e.g., existing in-service cables and pipelines) to survey 200m either side of the proposed crossing location to confirm the location of the asset and its depth of burial. The survey provided accurate information that would be used when designing infrastructure crossings.

18.4.24 The interpretation of the geophysical survey was used to focus the geotechnical and environmental survey strategies.

Table 18.9: Geophysical and geotechnical survey strategy

Type of survey	Method(s)	Sampling strategy/description	Start date	End date
Geophysical	MBES	• Entire Draft Order Limits. • Nearshore data acquired at frequency of 450kHz. • Offshore data acquired at frequency of 400kHz. • Grid parameter of 0.5 x 0.5m. • Identification of sand megaripples, sandwaves, boulders and bedrock outcrops.	Offshore survey: • 19/05/2024	Offshore survey: • 10/06/2024
	SSS	• Entire Draft Order Limits. • High frequency 600kHz. • Identification of seabed features, obstructions and seabed sediment variations.	Nearshore survey: • 20/05/2024 Intertidal survey: • 28/07/2024	Nearshore survey: • 29/05/2024 Intertidal survey: • 28/07/2024
	SBP	• Entire Draft Order Limits. • Operating frequency of 2 – 16kHz. • Required penetration of 5m achieved along the surveyed areas. • Identification of different		

Type of survey	Method(s)	Sampling strategy/description	Start date	End date
		sedimentary layers from the seabed and 5m to 10m below the surface.		
	Magnetometer	• Entire Draft Order Limits. • Average altitude above the seafloor was 3.1m across the survey site. • Identification of ferrous objects including potential unexploded ordnance (UXO), pipelines, anchors etc.		
Geotechnical	Vibrocore and cone penetrometer tests (CPTs)	• 190 vibrocores and CPTs were acquired with a nominal spacing of every 2km. • 6m capacity, 100mm outer dimension • Data acquired to ground truth sub-bottom profiler data and for engineering and archaeological purposes.	Onshore survey Walberswick: • 21/10/2024 Offshore survey phase 1: • 29/08/2024 Offshore survey phase 2: • 12/11/2024 Nearshore survey Southwold: • 27/10/2024 Nearshore survey Walberswick • 02/11/2024	Onshore survey Walberswick: • 25/10/2024 Offshore survey phase 1: • 15/09/2024 Offshore survey phase 2: • 29/12/2024 Nearshore survey Southwold: • 30/10/2024 Nearshore survey Walberswick: • 04/11/2024

18.4.25 The purpose of the geotechnical survey was to evaluate the nature and mechanical properties of the superficial intertidal and seabed sediments. Vibrocores and CPTs were acquired at regular 2km intervals along the Proposed Scheme. This allowed for both ground truthing of the geophysical interpretation but also testing to determine mechanical properties.

18.4.26 The benthic survey is described in detail in **Chapter 19 Intertidal and Subtidal Benthic Ecology** of this PEIR. However, of note to the characterisation of the marine physical environment, the survey included the acquisition of sediment samples, which were used to determine sediment composition (including particle

size) and tested for sediment contamination (heavy and trace metals, total organic carbon and presence of hydrocarbons). Geophysical surveys will be provided as part of the environmental statement (ES).

Assessment methodology

18.4.27 The approach to assessment is set out in **Chapter 5 EIA Approach and Methodology** of this PEIR. This has informed the approach used in this marine physical environment assessment.

18.4.28 The criteria for characterising the value and sensitivity and magnitude for marine physical processes are outlined in **Table 18.10** and **Table 18.11**, respectively, while the assessment of significance is provided in **Table 18.12.**

Table 18.10: Definitions of value and sensitivity for marine physical processes

Receptor Value and Sensitivity	Description
Very High	Value: Very high importance and rarity, international scale (e.g., designated feature of an SAC). Likely to be minimal potential for substitution. Sensitivity: The receptor has little or no capacity to absorb change without fundamentally altering its present character.
High	Value: High importance and rarity, national scale (e.g., designated feature of an MCZ). Likely to be minimal potential for substitution. Sensitivity: The receptor has little or no capacity to absorb change without fundamentally altering its present character.
Medium	Value: Medium importance and rarity, regional scale (e.g., supporting feature of a SPA, or cited feature of a SSSI). Sensitivity: The receptor has a moderate capacity to absorb change without fundamentally altering its present character.
Low	Value: Low importance and rarity, local scale. Sensitivity: The receptor has some tolerance to change without detriment to its character.
Negligible	Value: Not considered to be important (e.g., common or widespread). Sensitivity: The receptor is resistant to change and has capacity to accommodate the proposed changes.

Table 18.11: Definitions of impact magnitude criteria for marine physical processes

Impact Magnitude	Definition
High	Permanent change, total loss or major alternation to key elements/features of the baseline conditions such that post development character/composition of baseline conditions would be fundamentally changed
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition will be materially changed

Impact Magnitude	Definition
Low	Noticeable, temporary measurable change in attributes or quality. Minor shift away from baseline conditions. Changes arising from the alterations will be detectable but not material; the underlying character/composition of the baseline conditions will be similar to the pre-development situation.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a 'no change' situation.

18.4.29 The significance of an effect, either adverse or beneficial, would be determined using a combination of the magnitude of the impact and the sensitivity of the receptor. A matrix approach is used throughout all topic areas to ensure a consistent approach within the assessment. This is described further in **Chapter 5 EIA Approach and Methodology** of this PEIR and is replicated for ease in **Table 18.12.**

Table 18.12: Assessment of significance

Magnitude of impact	Receptor Value or Sensitivity				
	Very High	High	Medium	Low	Negligible
High	Major	Major	Moderate	Moderate	Minor
Medium	Major	Moderate	Moderate	Minor	Negligible
Low	Moderate	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Minor	Negligible	Negligible	Negligible

Cumulative assessment

18.4.30 **Chapter 28 Cumulative Effects** of this PEIR defines the methodology for the assessment of cumulative effects. The marine physical environment assessment of intra- and inter-project cumulative effects will be carried out and reported within the ES to be submitted with the application for development consent.

18.4.31 The Zone of Influence for the inter-project cumulative effects assessment of the marine physical environment assessment comprises a 15km buffer around the Draft Order Limits, as per the study area. This is based on the sediment dispersion modelling presented in **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR.

Guidance

18.4.32 In addition, the marine physical environment assessment has been undertaken in accordance with relevant guidance and has been compiled in accordance with professional standards. The guidance and standards which relate to this assessment are:

a. Natural England Offshore wind cabling: ten years' experience and recommendations (Ref 41);
b. Nature conservation considerations and environmental best practise for subsea cables for English Inshore and UK offshore waters (Ref 42);
c. Review of Cabling Techniques and Environmental Effects applicable to the Offshore Wind farm Industry (Ref 43);
d. General advice on assessing potential impacts of and mitigation for human activities on Marine Conservation Zone (MCZ) features, using existing regulation and legislation (Ref 44);
e. Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects (Ref 45);
f. The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) Assessment of the Environmental Impacts of Cables (Ref 46);
g. OSPAR Guidelines on Best Environmental Practice (BEP) in cable laying and operation (Ref 47);
h. Offshore wind farms: guidance note for Environmental Impact Assessment in respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) requirements: Version 2. (Ref 48);
i. Guidance Note (GN). Marine Physical Processes Guidance to inform Environmental Impact Assessment (EIA). GN041 (Ref 49);
j. Coastal Process Modelling for Offshore Wind Farm Environmental Impact Assessment: Best Practice Guidance (Ref 50);
k. Development of cumulative impact assessment guidelines for offshore wind farms and evaluation of use in project making (Ref 51);
l. Nationally Significant Infrastructure projects: Advice on the Water Framework Directive (Ref 52); and
m. Flood Risk Assessments: Climate change allowances (Ref 53).

18.5 Assessment assumptions and limitations

18.5.1 This section provides a description of the assumptions and limitations to the marine physical environment assessment. The information provided in this PEIR is preliminary, the final assessment of significant effects will be reported in the ES.

18.5.2 The PEIR has been produced to fulfil the Applicant's consultation duties in accordance with Section 42 of the Planning Act 2008 (PA2008) and enable consultees to develop an informed view of the likely significant effects of the Proposed Offshore Scheme.

18.5.3 This PEIR has been collated based on a range of publicly available data, supported by available survey data collected for the Proposed Offshore Scheme.

18.5.4 The project description, including details pertaining to construction methods is still being developed and to address uncertainty in methods and design parameters, a precautionary approach has been adopted.

18.5.5 Baseline understanding of SSC is based on the 2016 Cefas Suspended Sediment Climatology (Ref 54). An updated Suspended Sediment Climatology considering data collected over a longer duration is believed to be under development but as of May 2025 has not yet been made publicly available. The availability of an updated report will be checked for the ES.

18.5.6 The numerical modelling assessment of fine sediment dispersion associated with cable installation activities (including pre-sweeping of sandwaves and cable burial) applied a number of assumptions to derive suitable sediment source terms to apply. The assumptions made are outlined in detail in **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR**.**

18.5.7 Two CBRAs will be prepared prior to the DCO submission; a desk-top CBRA (completed) and a preliminary CBRA (not available for PEIR). The results presented in the desk-top CBRA are for a preliminary route corridor (referred to as Route B within the EIA Scoping Report) which was later the basis for the extent of the marine characterisation survey corridor. The desk-top CBRA will be updated with the results of the marine characterisation survey to further refine engineering designs. The preliminary CBRA will be available to inform the ES. Prior to construction, the Principal Contractor will undertake their own CBRA which would inform the final route engineering and micro-routeing. The desk-top and preliminary CBRA will inform the maximum design envelope presented in **Chapter 2 Description of the Proposed Scheme** of this PEIR. The CBRA undertaken by the Principal Contractor would need to comply with any Marine Licence conditions secured through the DCO.

18.5.8 Infrastructure crossings along the Proposed Offshore Scheme are detailed within **Chapter 2 Description of the Proposed Scheme** of this PEIR. Indicative areas requiring pre-sweeping (including volumes) were calculated based on the existing marine characterisation surveys and these are used to support the assessments provided in this chapter. These will continue to be refined for the ES.

18.6 Baseline conditions

18.6.1 To provide an assessment of the likely significance of the Proposed Scheme (in terms of the marine physical environment), it is necessary to identify and understand the baseline conditions in the study area. This provides a reference point against which potential changes in marine physical environment can be assessed.

18.6.2 The baseline section should be read in conjunction with the following supporting Appendices and Figures as found within this PEIR and Volume 3 of this PEIR respectively:

a. **Appendix 18.1 Sediment Dispersion Modelling;**
b. **Figure 18.1: Study area;**
c. **Figure 18.2: Bathymetry;**
d. **Figure 18.3: Seabed features;**
e. **Figure 18.4: Seabed sediments and percentage of fines from particle size analysis (PSA);**
f. **Figure 18.5: Seabed sediments and percentage of gravel from PSA;**
g. **Figure 18.6: Seabed sediments and percentage of sand from PSA;**
h. **Figure 18.7: Tidal ranges for spring and neap tides;**
i. **Figure 18.8: Peak flows for spring and neap tides;**
j. **Figure 18.9: Annual mean Suspended Sediment Concentration (SSC);**
k. **Figure 18.10: Seasonal mean SSC - Winter (January) and Summer (June);**
l. **Figure 18.11: Arsenic contamination from sediment samples;**
m. **Figure 18.12: Designated sites in the study area and surrounding area;** and
n. **Figure 18.13: Sandwave pre-sweeping areas.**

18.6.3 Kilometre Points (KPs) are used throughout this Chapter to provide context as to where within the study area a feature lies. The KPs are referenced as KP0 – to KP180, with KP0 defined at the proposed Landfall Site.

Current baseline

Coastal form

18.6.4 The coastline within the study area extends from Lowestoft in the North to Thorpeness in the South. Notable coastal features (from north to south) include Lowestoft Harbour, South Beach, Pakefield Beach, Kessingland Cliff fronted by Kessingland Beach, Benacre Broad and sluice, Covehithe Beach, Easton Bavents Cliffs, Southwold Headland and Beach, the mouth of the River Blyth, Walberswick Beach, Dunwich Beach, Minsmere sluice, Sizewell A and B Nuclear Power Stations, Sizewell Beach and Thorpeness Beach.

18.6.5 The coastline is generally made up of soft geology (predominantly sand and gravel). Much of the sediment that makes up the present shoreline has come from erosion of the coast and nearshore area over the last 10,000 years as sea level rose and the East Anglian coast eroded after the last ice age. This large-scale erosion provided most of the sediment now retained as shingle and sand beaches.

18.6.6 Sediment was also historically deposited close to the shoreline as banks, such as the natural shingle bank in front of Walberswick marshes. These banks are moved by waves and currents, driving a cycle of erosion and deposition.

18.6.7 The sediment transport along the coast tends to be southward at the proposed Landfall, switching to northward south of Dunwich. Conversely, sediment transport further offshore of the proposed Landfall is northward, switching to southward south of Dunwich (Ref 55).

18.6.8 Man-made defences are present along a 1.6km length fronting the town of Southwold where a sea wall promenade is present. The defences were upgraded in 2005/06 with new rock and timber groynes designed to maintain higher beach levels and protect the foundations of the sea wall. North of the sea wall promenade the Easton Bavents cliffs have eroded to outflank the northern limit of the sea wall and further erosion in this area could result in failure of the sea defences by outflanking which could result in extensive flooding to Southwold (Ref 55).

18.6.9 The proposed Landfall is included in the area covered by the ongoing Blyth Estuary Strategy, a flood reduction measure undertaken within the Suffolk East Management Catchment of the Anglian River Basin District (Ref 55). The proposed Landfall is included in the measure area due to its location close to the mouth of the Blyth Estuary, under which the defences at the harbour will be maintained until the end of their operational life (this was estimated as 20 years in 2007 for the defences excluding the Reydon Marshes bank, which was considered to have less than five years remaining (Ref 56)). The policy will be reviewed again in 2027 (Ref 57). The Blyth River mouth is trained (constrained by a fixed structure) along both the north (Southwold) and south (Walberswick) sides. The South Training Arm is now at critical risk of structural failure, as identified in the 2024 Port Marine Safety Code audit of Southwold Harbour (Ref 57). The training arms along with features such as the Southwold Headland, do not act as barriers to the general supply of sediment to the nearshore zone to the south.

18.6.10 There are no hard engineering structures at the proposed Landfall, but there are several natural sea defence systems in the form of dunes and embankments (Ref 55). The Walberswick dune system (which lies to the north east of the proposed Landfall) is approximately 75m wide and up to 5m in height with a gravel veneer at their base (Ref 57). A shingle embankment runs from Walberswick to Dunwich and has a known history of breaching during storm events affecting the freshwater habitats behind the ridge. In the past the Environment Agency has repaired the shingle barrier using beach material, however as the volume of shingle has reduced this no longer takes place (Ref 55). The Dunwich River channel which runs behind the embankment and the area of natural high ground to the north of the river channel are both also considered to contribute to flood risk management.

18.6.11 All of the sea defence assets at Walberswick are owned and maintained by the Environment Agency, however there is no known regular maintenance of these assets (Ref 55). The dunes were last inspected in January 2024 and assessed to be in ‘fair’ condition, while the beach and natural high ground were inspected in

August 2022 although no condition was recorded for the beach and the condition of the high ground was assessed as 'poor'. The channel has no known inspection programme (Ref 59).

18.6.12 While the embankment is not actively managed by the Environment Agency, the current trend along the shoreline at the proposed Landfall is one of accretion (Ref 60Ref 61). This is in contrast to the net observed trend along the adjacent coast which as a whole suffers some degree of erosion. As sea level has risen in the past the coast has tended to retreat, and the risk of retreat would increase with ongoing sea level rise.

18.6.13 The SMP strategy is to continue to protect the coast at the proposed Landfall (i.e. to hold the line through maintaining existing defences) but to allow natural erosion to continue to the north at Covehithe and along the cliff and broads between Kessingland and Southwold (i.e. no active intervention). The strategy immediately to the north and south of the proposed Landfall is managed realignment (with an intention for a natural shoreline).

Bathymetry and seabed features

18.6.14 As shown in **Figure 18.2** of this PEIR, water depths across the study area are less than 55m below Mean Sea Level (MSL), with deepest water depths in the central section of the Draft Order Limits (approximately around KP63 – 73). From the proposed Landfall the water depths deepen to more than 20m below MSL within approximately 4km of the coast. Water depths at the offshore extent of the Draft Order Limits are approximately 30m below MSL.

18.6.15 Newcome Sand and Stanford Channel lie within the 15km study area to the north of KP0 to KP10 at Lowestoft, while Dunwich Bank, Sizewell Bank and Aldeburgh Napes lie to the south. Several sand bank features also lie outside of the 15km study area to the north, including the banks of Holm Sand (KP10) and Smiths Knoll (KP73).

18.6.16 **Figure 18.3** of this PEIR shows seabed features along the Draft Order Limits. Notable areas of sandwave features have been identified along approximately 8-9% of the Proposed Scheme (including around KP23, KP66, KP108, KP118 and KP146), with heights typically in the range of 2-10m and wavelengths of around 200-800m. The majority of the sandwaves are relatively small, with only 3% of the Draft Order Limits having sandwaves higher than 5m. Mega ripples are present along a large proportion of the Draft Order Limits as they are typically present on the flanks of sandwaves and on the seabed where sandwaves are absent. These features indicate a mobile bed. In the nearshore region (KP0 to KP10), there are sections of mottled seafloor, ripples and scour, as well as small sections of Sabellaria reef (see **Figure 18.3** of this PEIR, and **Chapter 19 Intertidal and Subtidal Benthic Ecology** of this PEIR for discussion on Annex I reef habitat).

Geology and seabed sediments

18.6.17 The Southern North Sea Basin has developed as a result of a long and complex history of basinal subsidence interspersed with discrete periods of uplift and erosion. Lower Paleaozoic sediments are likely to be several kilometres thick beneath most of the Southern North Sea.

18.6.18 The geology across the study area is characterised by Holocene sand deposits overlying Quaternary deposits, with the thickness of Holocene sands generally varying from around 1m to more than 20m across sandwave fields. The underlying Quaternary deposits are typically more than 50m thick within the study area, except for a small area at the inshore end of the Draft Order Limits where deposits are 30-50m thick. These overlay Tertiary bedrock, which is Mudstone across most of the Draft Order Limits (comprised of fine-grained clays and muds).

18.6.19 The seabed composition along much of the Draft Order Limits is classified as sand, slightly gravelly sand or gravelly sand (i.e. course-grained sediment). The Draft Order Limits also cross a small patch of sandy gravel approximately 20km offshore (around KP23 to KP58) and a small patch of sandy mud approximately 3km offshore at KP4 (**Figure 18.4** of this PEIR).

18.6.20 More detailed sediment data from grab sampling at 81 sites through the study area show that surficial sediment is predominantly comprised of sand, with an average composition of 86% sand (**Figure 18.6** of this PEIR), 6% gravel (**Figure 18.5** of this PEIR) and 8% fine-grained silt and clay (**Figure 18.4** of this PEIR). The sediment in the nearshore region (inshore of KP10) of the study area has a much higher percentage of fines (<63μm grain size diameter) with up of 63% fine-grained silt and clay (**Figure 18.4** of this PEIR), 30% sand (**Figure 18.6** of this PEIR) and 7% gravel (**Figure 18.5** of this PEIR).

18.6.21 Subsurface sediment data from vibrocores indicates that the subsurficial sediments (from samples between 0.5m and 2m below the seabed surface) are predominantly sand. The data indicate that the subsurface sediments have a lower percentage of fines than the surficial sediments in the nearshore region (reducing from 63% to 8% at depths of more than 0.5m below the seabed surface) and a similar percentage of fines as surficial sediments in most of the rest of the study area. The only exception to this is between KP85 and KP130 where subsurficial sediments show an increase in the percentage of fines from less than 10% in the upper 0.5m to around 70% between 0.5m and 2m below the seabed surface.

Tides

18.6.22 Tides in the study area are semi-diurnal, with two high and two low tides per day.

18.6.23 The tides vary significantly across the study area due to the presence of an amphidromic point (a location where there is minimal tidal change) which is

centred slightly east of the proposed Landfall near the East Anglia 3 Offshore Wind Farm (OWF).

18.6.24 The UK Renewables Atlas (Ref 17) shows that the tidal range reduces in an offshore direction, with spring tidal ranges of more than 2m at the coast reducing to less than 1m at the offshore extent (**Figure 18.7** of this PEIR). Tidal ranges also vary north-south, with larger ranges in the northern part of the study area. Tidal levels at three locations across the study area are given in **Table 18.13,** refer to **Figure 18.7** of this PEIR for locations.

18.6.25 Tidal currents are generally southwards on the flood tide and northwards on the ebb tide and are bi-directional except in the north/offshore part of the study area where flows are more orbital. Superimposed on this regional scale flow pattern, local flow variations can be expected to occur in response to bathymetric features (for example with local flow circulations around sand banks).

18.6.26 The UK renewables Atlas shows variable spring tide flows across the study area (**Figure 18.8** of this PEIR). Slowest peak spring flows of around 0.5m/s occur at the offshore extent of the study area and fastest peak spring flows of around 1.35m/s occur in the shallower nearshore areas (within 30km of the shoreline). Peak flows on neap tides are typically just over half the peak spring tide flows.

Table 18.13: Tide levels across the study area relative to mean sea level (MSL) (Ref 62)

	Level (m above MSL)		
	UK_NS1	EA3B	CGF
Highest Astronomical Tide (HAT)	1.00	0.50	1.32
Mean High Water Spring (MHWS)	0.77	0.30	0.96
Mean High Water Neap (MHWN)	0.55	0.18	0.62
Mean Low Water Neap	-0.67	-0.18	-0.60
Mean Low Water Spring	-1.04	-0.29	-0.91
Lowest Astronomical Tide (LAT)	-1.47	-0.42	-1.25

Non-tidal influences

18.6.27 Superimposed on regular tidal signals in water levels and flows are various non-tidal influences, which mainly result from meteorological effects. For example, surges result from rapid changes in atmospheric pressure causing water levels to fluctuate notably above or below the tidal level. This effect can be further affected by local winds.

18.6.28 The North Sea is susceptible to storm surges and water levels can become elevated by 0.5m above HAT levels under a 1 in 1 year return period storm surge event, by 1.5m for a 1 in 100 year return period surge event and by 2.0m for a 1 in 1000 year return period surge event.

18.6.29 Currents across the study area are dominated by the tidal forcing, with occasional increases in speed during high winds associated with passing extra-tropical storms. Storm surges may modify the tidal flows, with a predicted maximum surge current of 0.4m/s associated with an approximately 1 in 50 year surge event (Ref 63).

18.6.30 In addition to surges, currents can also be influenced by wind stress at the surface and by waves. The influence of winds is mainly constrained to the near surface flows, while wave driven flows will vary with wave height and wave period.

Wind and waves

18.6.31 Prevailing winds across the study area are from the southwest, with hourly mean wind speeds of up to 3.3m/s (Ref 62). More typically, winds vary between 5 and 10m/s with wind speeds increasing slightly with distance offshore.

18.6.32 The wave climate across the study area is controlled by a combination of locally generated wind waves and swell waves generated elsewhere in the North Sea. The inshore section of the study area is sheltered to dominant wind directions from the southwest, while the offshore section of the study area is more exposed and can be influenced by waves directed away from the coast.

18.6.33 Wave heights reduce in an onshore direction as a result of friction effects in the shallower nearshore waters (**Table 18.14**). Mean significant wave heights close to the proposed Landfall are 0.7m, while at the offshore end of the Proposed Scheme mean significant wave heights are up to 1.5m.

Table 18.14: Mean wave and wind conditions along the Proposed Scheme (Ref 64)

	Landfall	Offshore
Mean significant wave height (m)	0.7	1.5
Mean wind speed (m/s)	6.7	8.1

Temperature and salinity

18.6.34 In the southern North Sea, winter sea temperatures typically range from 4°C to 8°C, while Summer sea surface temperatures vary between 16°C and 19°C (Ref 65), with minimal changes both vertically and spatially. Salinity decreases both southward and onshore, influenced by freshwater inputs from surrounding landmasses. South of the Dogger Bank, salinities average around 34.8, decreasing to below 34.6 near the UK coast (Ref 65).

18.6.35 Data from routine water quality sampling provided by the Environment Agency are available local to the proposed Landfall and these are available in the WIMS water quality archive (Ref 15). Temperature and salinity data are collected for the bathing water season (May to September) at Southwold the Denes (10850) and Southwold Pier (10830) and throughout the year at a monitoring point (No.38)

between KP3 and KP4. All three stations show salinity to be between 33 and 34.6, with little temporal fluctuation (data collected between 2021 – 2024). Water temperatures exhibit a seasonal variation at the offshore monitoring point with a seasonal range between 20.7°C and 5.7°C for Summer and Winter months respectively. At the coastal sites, Summer temperatures are slightly higher, peaking at 21.8°C, for the Southwold Pier monitoring point and at 21.7°C, for the Southwold the Denes monitoring point.

Suspended sediment

18.6.36 Data from the 2016 Cefas Suspended Sediment Climatology model (Ref 54) provides long term average (1998 to 2015) annual and monthly readings of non-algal suspended particulate matter (SPM) (note that Cefas use the term non-algal SPM rather than SSC, but these terms are analogous and further discussion adopts the term SSC). An updated climatology model considering data collected over a longer duration is believed to be under development but as of May 2025 has not yet been made publicly available. The availability of an updated climatology model will be checked for the ES.

18.6.37 Annual average SSC values across the study area are highly variable, ranging from around 5mg/l at the offshore extent of the Proposed Scheme up to 47mg/l close to the proposed Landfall (**Figure 18.9** of this PEIR).

18.6.38 There is some seasonality in SSC (**Figure 18.10** of this PEIR), with highest values of more than 10mg/l at the offshore extent of the Proposed Scheme and more than 70mg/l close to the proposed Landfall during winter months. The higher SSC during winter months is associated with wave-stirring of sediment from the seabed during storm events, which occur more frequently in the winter months. During such conditions, values can reach greater than 80mg/l offshore, with up to 170mg/l having been recorded at the coast.

18.6.39 It should be noted that these measurements of SSC are representative of near-surface conditions under non-storm/cloud free conditions and as such are likely to provide an underestimate of average conditions, particularly in close proximity to the seabed. Other studies have shown that there are likely to be frequent short-term increases in background SSC in the near-bottom waters as a result of natural events, with much higher values during storm events (Ref 65).

18.6.40 These SSCs provide a natural background context for the assessment of effects of any temporary increases in SSC that may arise from the Proposed Scheme.

Water quality

18.6.41 Reviews of water quality data as part of the East Anglia OWF studies indicated that trace metals dissolved in seawater in the study area are generally lower than other sites within the Southern North Sea (Ref 34, Ref 35 and Ref 36).

18.6.42 The Draft Order Limits pass through the WFD Suffolk water body which is classed as a moderately exposed mesotidal water body (Water body ID

GB650503520002). Further information can be found in **Appendix 18.2 Proposed Scheme Water Framework Directive Assessment** of this PEIR.

18.6.43 Classification for physico-chemical parameters is classed as moderate as a result of dissolved inorganic nitrogen (DIN) concentrations in the water. The Reason For Not Achieving Good (RNAG) are listed as diffuse pollution from poor nutrient and livestock management practices and point sources associated with sewage discharges.

18.6.44 The EA's water quality data archive, Open WIMS (Ref 15) provides water quality samples for nutrients at two locations in the study area – North Sea No.38 located between KP3 and KP4 and North Sea No. 34 just under 10km north northwest of KP13. Both locations show peak DIN concentrations of 0.6 mg/l and orthophosphate concentrations of less than 0.05 mg/l. The measured DIN at these locations is below the WFD DIN 'high' standard for coastal waters, indicating a low nutrient enrichment in marine waters and a low risk of eutrophication. There are no standards in the WFD for Orthophosphates in coastal waters.

18.6.45 There are designated bathing waters at Lowestoft (North and South of Claremont Pier) and Southwold (The Pier and The Denes) (**Figure 18.12** of this PEIR). The Pier and The Denes at Southwold lie 2km and 0.8km north of the proposed Landfall, respectively, while the Lowestoft bathing waters are more than 10km from the Draft Order Limits.

18.6.46 All bathing waters in the study area have been classified as good or excellent since 2021.

Sediment quality

18.6.47 The study area does not overlap any active disposal sites other than those associated with the East Anglia OWF developments. Other disposal sites within the study area which are now closed include Warren Springs, the AEA experimental site, the North Sea dredge test site and the BBL pipeline temporary pre-sweep site. East Anglia ONE analysed five sediment grab samples in the Warren Springs disposal site which were used between 1987 and 1995 to test oil dispersants in the North Sea. No traces of contaminants were found in these samples and the MMO advised that impacts associated with the placement site could be scoped out of further assessment for the East Anglia THREE project.

18.6.48 There are oil and gas wells in the northern part of the study area and there is a potential that these wells could be a source of contamination. However, none of these lie within the Draft Order Limits and further, surveys undertaken for the East Anglia OWF developments (Ref 34, Ref 35 and Ref 36) identified no significant levels of contamination in the region.

18.6.49 Grab sampling was undertaken at 81 sites across the Draft Order Limits to provide a more detailed assessment of the sediment quality for the Proposed Offshore Scheme (see **Figure 18.4** of this PEIR for locations). All of the samples

were analysed for particle size distribution. Physio-chemical analysis was undertaken on 35 of the samples (at the locations shown in **Figure 18.11** of this PEIR) and nine were processed as MMO-accredited samples due to potential requirement for pre-sweeping of sandwaves at those sample locations. The samples were analysed for contaminants including heavy and trace metals (i.e. aluminium, arsenic, barium, cadmium, chromium, copper, lead, lithium, mercury, nickel, tin and zinc), Polychlorinated biphenyls (PCBs), Polycyclic Aromatic Hydrocarbons (PAHs), Extractable Organic Halogens (EOX), Organotins (Dibutyltin (DBT) and Tributyltin (TBT)), Total Hydrocarbon Content (THC) and Organochlorine Pesticides (OCPs).

18.6.50 A variety of reference values were used to assist in the interpretation of the sediment quality data collected for the Proposed Offshore Scheme as no single approach is relevant for all the sediment quality analyses undertaken. This included the United Kingdom Offshore Operators Association (UKOOA) sediment quality reference values for the UK North Sea. The UKOOA 50th and 95th percentile levels provide natural background levels for various parameters giving a measure of the median level and the level which is exceeded for 5% of data, respectively (Ref 66). To put the level of toxicity into context, the National Oceanic and Atmospheric Administration (NOAA) developed Effect Range Low (ERL) and Effect Range Median (ERM) levels for hydrocarbons and metals, whereby at that level adverse effects were reported in 10% (ERL) and 50% (ERM) of the data. The Chemical Action Levels (CAL) defined by Cefas are used as part of a weight of evidence approach to decision making on the disposal of dredged material to sea (Ref 67). Contaminant levels below CAL 1 are defined as being of no concern, levels between CAL 1 and CAL 2 are defined requiring further consideration and testing before a decision can be made and contaminant levels above CAL 2 are generally considered unsuitable for sea disposal.

18.6.51 Analysis of the 35 grab samples collected within the study area as part of the Proposed Offshore Scheme has shown that the THC and total n-alkane concentrations were below the UKOOA 95th percentile in the offshore areas (the majority of offshore sites were also below the 50th percentile), while the nearshore sites were consistently above the UKOOA 95th percentile. In addition, hydrocarbon signatures typical of background sediments were shown by the gas chromatography (GC) traces, with nearshore sites experiencing higher values due to contribution from North Sea runoff and terrigenous material. The total PAH levels were highest at the nearshore sites, where all the sites exceeded the UKOOA 95th percentile (0.336mg/kg) and one site marginally exceeded the NOAA ERL of 4.02mg/kg. As a result, NOAA levels are used due to their greater robustness and reliability.

18.6.52 Nine of the 35 grab samples collected within the Proposed Offshore Scheme were analysed for EOX, organotin compounds (tributyltin and dibutyltin), OCPs and PCBs and the results showed that they were all below their respective limits of detection.

18.6.53 In the nearshore area, concentrations of several metals (barium, cadmium, chromium, copper, lead, nickel, and zinc) exceeded the UKOOA Southern North Sea (SNS) 50th percentile reference values, with lead, mercury and zinc surpassing the 95th percentile at some sites, but with none of these exceeding the Cefas CAL 1 thresholds. At the offshore sites the metal concentrations were generally lower, with no metals exceeding the UKOOA 95th percentile thresholds. Arsenic concentrations exceeded the NOAA ERL reference value (8.2mg/kg) at most nearshore stations and surpassed Cefas CAL 1 (20mg/kg) at multiple locations (see **Figure 18.11)**, but the Cefas CAL 2 (100mg/kg) was not exceeded at any sites. Elevated arsenic levels can be attributed to natural geological sources as well as anthropogenic activities, including mining, smelting, chemical manufacturing, and agricultural runoff from major rivers in the Southern North Sea. All other metals were below Cefas CAL 1 levels and NOAA ERL levels, except for one exceedance of NOAA ERL for mercury at a nearshore sample site.

18.6.54 Overall, the results have shown that the concentrations of contaminants in sediments are generally higher in the nearshore area, decreasing offshore indicating that river input and run-off from land are significant sources. This trend is also related to the sediment composition, with the sediment in the nearshore of the study area predominantly made up of fine-grained silt and clay (22% to 78%) which has a greater surface area and absorptive capacity compared to coarser sand which dominates in the offshore areas (45% to 100%). The sediments throughout the majority of the study area are typically coarse sand and gravel, which pose a low risk for anthropogenic contaminants.

18.6.55 Analysis of the TOC and TOM of seabed samples collected as part of the benthic survey indicates concentrations to be highest in the nearshore sample locations. This is a result of both physical factors (higher proportion of finer sediment) and proximity to terrestrial sources (runoff and fluvial transport), and increased likelihood of local sources such as phytoplankton blooms. Measures of TOC and TOM represent the proportion of biological material and organic detritus in the sediment, and they provide a valuable primary indicator of the potential for nutrient cycling and availability within seabed sediments. It is not possible to estimate concentrations of nutrients such as nitrogen or phosphorous from measurements of TOC and TOM, other than to infer that increased nutrient concentrations would positively correlate with increased concentrations of TOC and TOM.

18.6.56 Levels of TOC are in the typical range that occurs within the North Sea (Ref 68) and as such the nutrients in the sediments would also be expected to be in the typical range of values.

18.6.57 Given the low number of exceedances of CAL 1 and NOAA ERL (only for arsenic plus one sample for mercury) the levels of contaminants and nutrients in the sediments within the Proposed Offshore Scheme is low.

Designated sites

18.6.58 Designated sites in the vicinity of the study area, which are designated for the protection and conservation of marine habitats of relevance to the marine physical environment are shown in **Figure 18.12** of this PEIR. These include:

a. Southern North Sea Special Area of Conservation (SAC): an area of importance for harbour porpoise, including key Winter and Summer habitat for this species. Most of the Proposed Offshore Scheme is contained within the Southern North Sea SAC with the exception of KP141 to KP180 (although it remains in close proximity to it);
b. Outer Thames Estuary Special Protection Area (SPA): classified for the protection of the largest aggregation of wintering red-throated diver in the UK and of foraging areas for common tern and little tern during the breeding season. The Proposed Offshore Scheme Draft Order Limits (to KP57) pass through or are within 2km of the SPA.
c. The Haisborough Hammond and Winterton Marine Protected Area (MPA) in the northern extent of the study area inshore of KP73 at a minimum distance of 10.4km from the Proposed Offshore Scheme Draft Order Limits;
d. The North Norfolk Sandbanks and Saturn Reef MPA in the northern extent of the study area between KP111 and KP124 at a minimum distance of 13km from the Proposed Offshore Scheme Draft Order Limits.

18.6.59 A number of coastal Sites of Special Scientific Interest (SSSI) are also present:

a. Minsmere - Walberswick Heaths and Marshes SSSI: designated for important habitats including coastal shingle vegetation outside the reach of waves. Minsmere - Walberswick is also designated as a Ramsar wetland. This site is located on the coast at the proposed Landfall; and
b. Leiston-Aldeburgh SSSI: designated for its diverse range of habitats which supports an abundant community of breeding and overwintering birds. This site is located at the southern extent of the study area, just under 15km from the Draft Order Limits.

18.6.60 As noted in section 18.6.45, a number of designated bathing waters lie within the study area, including Southwold The Denes, Southwold The Pier, Lowestoft (South of Claremont Pier) and Lowestoft (North of Claremont Pier).

Future baseline

18.6.61 Due to projected ongoing climate change the baseline environment will experience some change over time. The most up-to-date predictions of future climate change are provided in the UK Climate Change Projections 2018 (Ref 69).

18.6.62 The future change in climate over the UK would depend strongly on future emissions of greenhouse gases. UKCP18 uses scenarios for future greenhouse gases called the representative concentration pathways (RCPs) which were designed to cover a range of assumptions around future population, economic development and to explicitly include the possibility of mitigation of greenhouse gas emissions towards international targets. The RCP pathways lead to a broad

range of climate outcomes but are neither forecasts nor policy recommendations (Ref 69).

18.6.63 RCP2.6 represents a future in which the world aims for and is able to implement sizeable reductions in emissions of greenhouse gases, giving a sizeable chance of limiting global average warming to 2˚C.

18.6.64 RCP8.5 represents a world in which global greenhouse gas emissions continue to rise.

18.6.65 RCP4.5 and RCP6.0 consider some emission reductions based on pledges to reduce emissions as per the Paris climate agreement, which extends to the year 2030. If, after 2030, no further emission reductions are achieved but emissions do not rise then a number of studies suggest the temperature outcome of RCP4.5 may be the most likely. However, RCP6.0 allows for some further increase in emissions.

18.6.66 The four RCPs considered in UKCP18 attempt to capture a range of potential alternative futures, spanning a range of outcomes. The adoption of the climate response to a RCP8.5 future provides a precautionary view.

18.6.67 Aspects of the baseline environment which could experience change are discussed in the following paragraphs.

Sea level rise

18.6.68 Sea level rise projections have been made for a range of future greenhouse gas emission scenarios. For this assessment the RCP8.5 scenario has been adopted, this is the future scenario whereby greenhouse gas emissions continue to grow unmitigated. The 95th percentile case projects that sea levels would rise by 0.42m at the proposed Landfall from 2025 to 2065, which allows for the 40-year design life of the Proposed Offshore Scheme. The sea level rise projections are similar along the length of the Proposed Scheme.

Tides and water levels

18.6.69 The astronomical tide levels and storm surge levels would increase over the lifetime of the Proposed Offshore Scheme due to sea level rise increasing the mean water level. The astronomical tidal range and resultant tidal currents are unlikely to measurably change due to the increase in the mean water levels.

Wind and waves

18.6.70 Environment Agency Guidance (‘Flood Risk Assessments: Climate Change Allowances’, 2016) states that wind speeds and wave height should be increased by 5% between 1990 and 2055 and by 10% for the period 2056 to 2115. Therefore, the combination of sea level rise and a predicted increase in wave heights could result in higher wave energy reaching the coastline which in turn could result in increased shoreline erosion and influence the local beach morphology.

Sediment characteristics

18.6.71 In view of the SMP strategy to hold the line, the composition or distribution of sediment on the beaches or on the seabed in the region are unlikely to be altered by climate change.

Water quality

18.6.72 The bathing waters in the nearshore areas close to the proposed Landfall are currently (2024) classified as 'excellent' (Southwold The Denes and Southwold The Pier), or 'good' (Lowestoft (North of Claremont Pier) and Lowestoft (South of Claremont Pier) and it is expected that this will remain as the future baseline with climate change not expected to alter this.

18.7 Embedded design mitigation and control measures

Design and embedded mitigation measures

18.7.1 As described in **Chapter 2 Description of the Proposed Scheme** of this PEIR, a range of measures have been embedded into the Proposed Offshore Scheme design to avoid or reduce environmental effects. These mitigation measures form part of the design that has been assessed, which for marine physical environment are listed in **Table 18.15.**

18.7.2 The Proposed Offshore Scheme Draft Order Limits were positioned following a detailed desktop design process. Key seabed features such as sand banks and areas of rock outcrop have been avoided. Where seabed features such as sandwaves and megaripples could not be avoided route development work was undertaken during the marine characterisation campaign to seek a marine cable route that minimised interaction with the features and maximised the potential for cable burial in the seabed. This design process is described in **Chapter 3 Alternatives and Design Evolution** of this PEIR.

Table 18.15: Design and embedded mitigation measures for the marine physical environment

Commitment Reference Code	Measure	Compliance Mechanism
OD01	All cables will be installed in one trench.	CEMP secured by DML
OD03	A trenchless cable installation method (such as horizontal directional drilling) would be used to avoid disturbance to surface sediments and habitats, with the exit point seaward of the 0m LAT water depth contour.	CEMP secured by DML
OD04	The intention is to bury the HVDC Submarine Cables in the seabed, except in areas where trenching is not possible e.g.	CEMP secured by DML

Commitment Reference Code	Measure	Compliance Mechanism
	where ground conditions do not allow burial or at infrastructure crossings.	
OD05	External cable protection shall only be used where it can be demonstrated that adequate burial depth cannot be achieved (e.g., where ground conditions do not allow burial or at infrastructure crossings); the footprint of any external protection shall be the minimum required to ensure adequate cable protection and stability.	CEMP secured by DML
OD06	In sites designated for benthic features cable protection materials would be selected to match the environment (e.g. rock of similar grade as the receiving environment) where feasible.	CEMP secured by DML
OD08	Micro-routeing within the Order Limits to avoid sensitive environmental constraints and minimise the risk of exposure by seabed mobility	CEMP secured by DML
OD09	The profile of rock berms used for cable protection would be designed to minimise the potential for scour to occur as much as possible (including alignment with flow and profiling).	CEMP secured by DML
OD10	Sediment displaced for exit pits and cable installation (sandwave clearance and trenching) would be side cast/locally placed.	CEMP secured by DML
OD12	Routine surveys and inspections of the HVDC Submarine Cables and associated protection measures would be conducted through the lifetime of the project, to ensure they remain in good condition, and adequately protected.	CEMP secured by DML
OD15	The risk of frac-out would be mitigated through design by undertaking ground investigation to determine the soil properties and understand if natural fissures could be present along the borehole alignment. This would include factoring in verified geology from ground investigation boreholes to provide a detailed hydrofracture analysis and calculation. This information would inform the design of trenchless methods at suitable depths to minimise the risk of frac-out.	Design secured by DML

Control measures

18.7.3 Control measures are set out in **Appendix 2.2 Outline Offshore Construction Environmental Management Plan** of this PEIR which will manage the effects of construction. The measures of particular relevance to marine physical processes are listed in **Table 18.16**.

18.7.4 Several management plans would be provided as Outline Management Plans with the application for development consent to support the DML. These would include an Outline Construction Environmental Management Plan (CEMP)

(including biosecurity plan details) and Outline Marine Pollution Contingency Plan (MPCP). An Outline Offshore CEMP can be found in **Appendix 2.2** of this PEIR. These documents would outline control measures to be implemented to comply with legislation (e.g., in relation to the prevention of oil and chemical spills) during all phases of the Proposed Offshore Scheme. Final management plans would be submitted in accordance with the DML to discharge the licence conditions.

18.7.5 The Applicant would ensure that all work that is undertaken during construction, operation and maintenance and decommissioning complies with the requirements of relevant national and international legislation.

Table 18.16: Control measures for the marine physical environment

Commitment Reference Code	Measure	Compliance Mechanism
OC01	An offshore Construction Environmental Management Plan (CEMP) including an Emergency Spill Response Plan (ESRP), Waste Management Plan, Marine Pollution Contingency Plan (MPCP) and Marine Mammal Mitigation Plan (MMMP) and a dropped objects procedure would be produced prior to installation.	DML secured through DCO
OC02	All project vessels must comply with the International Regulations for Preventing Collisions at Sea (1972) (IMO, 2019a), regulations relating to International Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73/78) (IMO, 2019e) with the aim of preventing and minimising pollution from ships and the International Convention for the Safety of Life at Sea (SOLAS, 1974).	CEMP secured by DML
OC03	An installation machine failure contingency plan would be produced prior to installation	CEMP secured by DML
OC04	All oil, fuel and chemical spills would be reported to the MMO Marine Pollution response team	DML secured through DCO
OC05	Drilling fluids required for trenchless operations and maintenance would be carefully managed to minimise the risk of breakouts into the marine environment. Specific avoidance measures would include: • the use of biodegradable drilling fluids (pose little or no risk (PLONOR) substances) where practicable; • drilling fluids would 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. Chemicals would be chosen from the list of chemicals approved under the Offshore Chemical Notification Scheme	CEMP secured by DML

Commitment Reference Code	Measure	Compliance Mechanism
	(https://www.cefas.co.uk/data-and-publications/ocns/) and a chemical risk assessment would be provided as part of the CEMP.	

18.8 Assessment of effects

18.8.1 This section presents the preliminary assessment of likely significant effects on marine physical environment resulting from the construction, operation and maintenance, and decommissioning of the Proposed Offshore Scheme. The likely significant effects of the Proposed Offshore Scheme are identified taking into account the embedded design mitigation and control measures.

18.8.2 Following assessment, requirements for further mitigation are considered (**Section 18.9.**).

Construction

Changes to coastal morphology

18.8.3 No infrastructure would be present within the intertidal area during construction and there is therefore no potential for direct impacts on coastal morphology. However, changes to subtidal morphology could potentially alter the propagation of waves to the shoreline and indirectly disturb the coastal morphology by impacting sediment transport pathways.

18.8.4 During construction, an excavated 'exit pit' may be required at the HDD exit points to clear unconsolidated sediment layers. In addition, the HDD ducts may require temporary weighting using clump weights or rock bags between installation and cable pull-in (after which the ducts would be buried in the seabed). Depending on the construction programme and any seasonal sensitivities at the proposed Landfall, a bellmouth could also be temporarily placed on the seabed. Once the cable is installed the bellmouth and any weighting would be removed and material excavated for the exit pits would be used to backfill the pits (either manually or naturally) and fully bury the HDD duct ends and HVDC Submarine Cables.

18.8.5 Should they be required, exit pits would be approximately 15m x 15m for up to 3 ducts and the use of any weighting or bellmouth would be small scale, only being present on the bed local to the duct. Given the very small magnitude/local scale and temporary nature of the excavated exit pits, weighting and bellmouth and given that they would be in water depths of at least 5m below LAT at a distance of 0.5km or more from shore, the receptor value and sensitivity is assessed as negligible and the impact magnitude is also assessed as negligible**.** Overall, it is

concluded that the significance of effect of changes to coastal morphology during construction are **Negligible** and **Not Significant.**

Temporary habitat loss/seabed disturbance

18.8.6 Seabed preparation and submarine cable installation activities have the potential to directly disturb the seabed morphology such as sandwaves and notable bathymetric depressions, potentially resulting in temporary habitat loss.

Sandwave clearance

18.8.7 Whilst avoidance of sandwaves and megaripples features through routeing design within the Order Limits would be implemented where possible, discrete sections of the Proposed Offshore Scheme may require pre-sweeping of mobile sandwaves. Such pre-sweeping would ensure that that the cable burial machine would not topple or tilt during installation and that the installation could reach the desired burial depth reducing the risk of cable exposure during operation.

18.8.8 Ripples and sandwaves have been identified along 8-9% of the route, equivalent to a length of 14.2km at the locations shown in **Figure 18.13** of this PEIR. Assuming a maximum clearance width of 20m the total area of seabed which could be disturbed by sandwave clearance is estimated to be 0.29km^2. The maximum volume of sediment disturbed by sandwave clearance is 170,000m^3.

18.8.9 Pre-sweeping would be undertaken by controlled flow excavator (CFE) or trailing suction hopper dredger (TSHD). If a dredger is to be used the sediment would be placed local to the extraction sites to aid sandwave recovery. The disposal locations would be agreed and defined in the DML. Indicative disposal locations have been provided in the PEIR (coincident with the sandwave clearance areas shown in **Figure 18.13**).

18.8.10 The mere presence of sandwaves indicates an active and dynamic environment. Following pre-sweeping, new sandwaves can therefore be expected to form so that any change in bedforms would only be temporary. A study of seabed dynamics and morphology undertaken on behalf of Ørsted energy to estimate restoration of seabed morphology after construction of the Race Bank OWF found that in the areas of high sediment mobility surveyed the seabed was found to be fully, or almost fully, recovered (>75% recovery in all areas) within the one to two years between the post trenching survey in 2016 to 2017 and the subsequent survey in 2018.

18.8.11 Net sandwave migration rates are of the order of 1 to 4m/year in northward direction (**Appendix 18.1 Sediment Dispersion Modelling** of this PEIR). This is lower than the net sandwave migration rates at Race Bank, where net sandwave migration rates of between 7 to 31m/year were observed. As such, recovery times in the study area could be slower than observed at Race Bank. Assuming that the migration rates are proportional to recovery timeframes, the recovery times could be around seven times slower than at Race Bank. However, the exact recovery timeframe at Race Bank is not known, with 75% of the areas

surveyed fully recovered during the one-to-two-year period between surveys – the full recovery could have occurred on timeframes of the order of weeks or months. The recovery time would likely depend on the occurrence of storm events, with large storm events likely to aid recovery.

18.8.12 The value and sensitivity of temporary habitat loss/seabed disturbance from sandwave clearance is assessed as low as the temporary and localised character of the proposed construction methods are not likely to influence the overall form and function of the bedform system due to the dynamic nature of natural sediment transport processes in the area. The impact magnitude is assessed as low and overall, the effect of temporary habitat loss/seabed disturbance is assessed as **Negligible** and **Not Significant**.

HDD exit pits

18.8.13 HDD (Trenchless cabling technique) would be used to connect the offshore cable to the onshore cable at the proposed Landfall. The HDD punch out location would depend on the outcome of further technical studies and design but is expected to target water depths between 5m and 9m below LAT at an indicative distance of <1km from MHWS.

18.8.14 As noted in **paragraph 18.8.4**, HDD exit pits may be excavated at the HDD exit points. This excavation would be undertaken by either a backhoe excavator (barge mounted) or a controlled flow excavator. Up to three excavation pits (one per duct) may be required, with each pit measuring up to 15m x 15m. Sediments would be cleared from the bed at the exit pits and placed locally so that the sediment remains within the local system and would not be removed from site (Commitment Reference OD10).

18.8.15 Peak spring flow speeds at the HDD exit points are typically around 0.55m/s and the median sediment grain size from samples collected approximately 1.3km offshore of the HDD exit points is around 30µm (medium to coarse silt). The excavated sediment would therefore be mobile under the action of spring tidal flows, and the exit pit would be likely to naturally backfill over a period of months.

18.8.16 The value and sensitivity of temporary habitat loss/seabed disturbance from HDD exit pits is assessed as low as the temporary and localised character of the proposed construction methods are not likely to influence the overall form and function of the bedform system due to the dynamic nature of natural sediment transport processes in the area. The impact magnitude is assessed as low and overall, the effect of temporary habitat loss/seabed disturbance is assessed as **Negligible** and **Not Significant**.

Permanent habitat loss

18.8.17 In areas where HVDC Submarine Cables are buried, trenches would be back-filled so that the change is temporary. Where burial cannot be achieved, cable protection would be required resulting in a permanent change in substrate. The areas where burial cannot be achieved include areas of hard substrate and areas

where the Proposed Offshore Scheme crosses other infrastructure (e.g., cables or pipelines).

18.8.18 The addition of cable protection would result in a change in substrate. The significance of effect would depend on the size of any cable protection measures required and the type of substrate the deposit is made on. In the instance of hard substrate, the addition of cable protection could also alter the physical bed characteristics. This change would be small in areas of existing bed rock but would be more significant in areas of hard sand and clay. Approximately 0.1% of the Draft Order Limits is classed as "Outcrop with a veneer of sand". Cable protection would be used where sufficient burial is not possible.

18.8.19 In the instance of infrastructure crossings, any change to substrate could be more significant (for example from sand to rock) and would be permanent (at least for the lifetime of the Proposed Scheme). The Proposed Offshore Scheme is expected to require up to 18 infrastructure crossings. Assuming a 150m crossing length and width of 14m yields a total surface area of 50,400m^2, equivalent to less than 0.03% of the Draft Order Limits.

18.8.20 Given the localised nature of cable protection, particularly for infrastructure crossings (where the change in substrate would be more significant), the value and sensitivity of the receptor is assessed as low. The impact is assessed as negligible, and the significance of effect is assessed as **Negligible** and **Not Significant.**

Temporary increases in suspended sediments and subsequent deposition

18.8.21 Seabed preparation and cable installation activities could locally suspend sediments resulting in increased SSC. In the near-field (within 5 to 10m of the activity) sediment disturbed by construction activities would result in very high sediment concentrations (of the order of hundreds of mg/l), which would last while the activity resulting in the sediment disturbance persists. A large proportion of this sediment would rapidly settle back to the bed, in close proximity to the disturbance site. However, fine sediment fractions in suspension will disperse and redeposit elsewhere on the seabed, potentially resulting in a reduction in fines close to the disturbance site and an increase in fines further away (due to the shorter settling times for coarser grained sediments).

18.8.22 Numerical modelling of the fine sediment suspended by construction related activities has been undertaken to predict the mid- to far-field SSC and sedimentation associated with pre-sweeping and cable burial for a range of hydrodynamic conditions, sediment types and release rates to capture the impact (in terms of plume extent, concentration, duration of increases and extent and thickness of deposits on the seabed). The assessment focused on the realistic worst case installation scenario, including pre-sweeping by TSHD and cable burial by jet trencher. The baseline information and geophysical, geomorphological and benthic surveys were used to provide the data inputs for

the assessment. The effects were assessed in terms of the difference caused relative to the normal range of natural occurrence and variability (as described in **paragraph 18.6.36** to **paragraph 18.6.40**). Full details on the modelling and results are provided in **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR.

18.8.23 Sediment disturbance associated with pre-sweeping was simulated along a 3km section of the Offshore HVDC Submarine Cable Corridor, focussed on an area where large sandwaves were identified during the geophysical survey. Sediment disturbance associated with jet trenching was simulated along the full length of the Offshore HVDC Submarine Cable Corridor for an installation speed of 500m/hr and along the inner 40% of the Offshore HVDC Submarine Cable Corridor (between the proposed Landfall and KP73) for an installation speed of 100m/hr. During design, the Offshore HVDC Submarine Cable Corridor was updated to avoid the area of largest sandwaves, involving a southward diversion of up to 2km along an 8km stretch (between KP55 and KP63 of the updated Offshore HVDC Submarine Cable Corridor, which now forms the Draft Order Limits). Given the similarities in particle size distribution (PSD) and flow speeds between the original and updated Offshore HVDC Submarine Cable Corridor, the results from the modelling assessment remain valid, although any impacts to SSC and sedimentation would be expected to be 1-2km further south between KP55 and KP63 than predicted by the model.

18.8.24 The modelling assessment predicted SSC increases would mainly be constrained within the study area. The only increases in SSC outside of the study area were associated with cable burial between KP5 and KP10 where increases in SSC of 15mg/l extend 1.5km beyond the northern boundary of the study area. This is due to the high percentage of fines and the closer alignment of the Draft Order Limits with the flow direction in this area. Increases in SSC outside the study area are short lived, with increases of more than 5mg/l only occurring for less than 2 hours. The area of impact outside the study area did not overlap any designated sites (with the Greater Wash MPA located more than 4km north of the northern extent of the study area).

18.8.25 Similarly, within the study area, increases in SSC of more than 5mg/l were predicted to occur for a short duration (less than seven hours) and higher increases in SSC of more than more than 50mg/l persisting for more than 0.5 hours were only predicted within the Draft Order Limits. Sedimentation of more than 0.1mm was only predicted to occur within the study area, while sedimentation of more than 1mm was only predicted to occur within the Draft Order Limits.

18.8.26 Sections of the Draft Order Limits where pre-sweeping could be required within or in close proximity (within 2km) to the Outer Thames Estuary SPA include KP14 to KP26, KP34 to KP36, KP42.5 to KP43.5 and KP55 to KP59. While sediment disturbance associated with pre-sweeping was not simulated in the model along this section of the Draft Order Limits, the flows are broadly similar in these areas

to the area where pre-sweeping was modelled. The sediment volumes in these areas requiring pre-sweeping are anticipated to be lower (with smaller bedforms present). The modelling results can therefore be used to predict the maximum extent, magnitude and duration of impact within the SPA, for pre-sweeping with increases of more than 5 mg/l only persisting for the order of hours. Similarly, increases in SSC from cable burial were only predicted to exceed 5mg/l for a short duration (less than seven hours) within the Outer Thames Estuary SPA.

18.8.27 The most inshore section identified as potentially requiring pre-sweeping is at KP14 to KP26. Flows in this area are mainly orientated parallel with the coast and as such, pre-sweeping is not expected to result in increases in SSC at the designated bathing waters, with flows expected to advect the plume along the coast rather than in an onshore direction towards the bathing waters. While sediment disturbance associated with pre-sweeping was not simulated in the model along this section of the Draft Order Limits (as review of data indicates that pre-sweeping is unlikely), sediment releases associated with cable installation between KP14 and KP26 did not result in an increase in SSC at any of the bathing waters within the study area, confirming this assessment.

18.8.28 Pre-sweeping could be required between KP55 and KP67 which is within 11km of the Haisborough, Hammond and Winterton SAC. Numerical modelling of the fine sediment disturbance associated with dredging with a TSHD in this area predicted that no increases in SSC above background and no sedimentation within the SAC would occur.

18.8.29 Similarly, numerical modelling of the fine sediment disturbance associated with cable burial predicted no increases in SSC above background and no sedimentation within the Haisborough, Hammond and Winterton SAC.

18.8.30 Pre-sweeping could be required between KP98 and KP109 and between KP116 and KP121 which is within 14km of the North Norfolk Sandbanks and Saturn Reef SAC. Tidal flows in this area of the Proposed Scheme are orientated north-south with slower speeds (peaking around 1m/s on spring tides) than further inshore and as such, pre-sweeping is not expected to result in increases in SSC or sedimentation within the SAC. While sediment disturbance associated with pre-sweeping was not simulated in the model along this section of the Proposed Offshore Scheme, sediment releases associated with cable installation in these areas was modelled and was not predicted to result in an increase in SSC or any sedimentation within the SAC, confirming this assessment.

18.8.31 Approximately 20% of the Outer Thames Estuary SPA (only considering the two polygons of the SPA which intersect with the Draft Order Limits) is predicted to be affected by an increase in SSC of more than 5mg/l at any time during construction, with the largest impact from cable burial at the slower installation rate of 100m/hour. The area predicted to be impacted at any one time is much smaller, being less than 0.1% of the SPA areas which intersect the Draft Order Limits. The duration of time where SSC is increased by more than 5mg/l at any

point within the Outer Thames Estuary SPA is 18 days, although the duration of time exceeded at any one point is much less than this (order of hours). Based on an indicative constant installation rate of 100m/hour, cable burial along the full 182km length of the Proposed Offshore Scheme would take 75 days to complete, while the overall length of cable burial operations and maintenance would be completed over a period of several years (with seabed preparation, downtime from weather and maintenance, infrastructure crossings, jointing and external cable protection placement all contributing to the overall installation program).

18.8.32 Less than 0.5% of the Outer Thames Estuary SPA is predicted to be affected by sedimentation of more than 1mm thick, constrained within the Draft Order Limits.

18.8.33 Approximately a quarter of the Southwold Pier bathing water and all of the Southwold the Denes bathing water are predicted to be affected by SSC of more than 5mg/l at some point during cable burial for the slower installation rate, but the impact time is short (1 to 2 hours). The maximum SSC was predicted to be 19 and 47mg/l at Southwold Pier and Southwold the Denes, respectively. For the quicker installation, no increase in SSC above 5mg/l was predicted in either bathing water with the southward flood flow directing the sediment plume away from the bathing waters.

18.8.34 During cable burial, increases in SSC of up to 0.5mg/l are predicted to occur at the Sizewell B intake, while sedimentation is predicted to be less than 0.1mm. Higher increases in SSC could occur at the Sizewell C intakes but the Sizewell C power station is not expected to be operational at the time of installation of the Proposed Offshore Scheme. Following installation, there are not expected to be any increases in SSC resulting from the installed cable.

18.8.35 Overall, changes in SSC from pre-sweeping and cable burial are predicted to be localised and short lived, and deposition is very small outside of the Proposed Offshore Scheme Draft Order Limits. Therefore, the value and sensitivity of increases in SSCs and deposition, is considered low.

18.8.36 The predicted temporary increases in SSC and sediment deposition are small in comparison to background levels and natural processes in the area; therefore, the magnitude of the impact is considered negligible, and the significance of the effect is assessed as **Negligible** and **Not Significant.**

Transboundary impacts - temporary increases in suspended sediments and subsequent deposition

18.8.37 With regards to the potential for sediment plumes to be transported into neighbouring territorial waters, the study area only intersects with the Dutch EEZ. Therefore, the only potential for transboundary effects is due to cable installation at the offshore end of the Draft Order Limits where the Proposed Scheme transits into the Dutch EEZ. In this region the flows are aligned almost parallel with the UK-Dutch EEZ boundary (with ebbing northward flows driving any plume slightly inshore into the UK EEZ while flooding southward flows would drive any

plume slightly offshore into the Dutch EEZ). Peak flows in this area are relatively slow (around 0.5m/s on spring tides, with an equivalent spring tide excursion of approximately 6.5km). Given the flow speeds and directions, any plume generated by cable installation activities occurring between approximately KP176 to the end of the Proposed Offshore Scheme (at KP182) could be transported into the Dutch EEZ on the flood tide. Any increases in SSC would be shorted lived occurring intermittently for two days or less depending on installation speeds. Further, the increases would only occur close to the seabed and would have a low magnitude. A similar impact in the UK EEZ would be expected to occur on the ebb tide from cable installation within the Dutch EEZ in the area close to the UK-Dutch EEZ border.

18.8.38 In view of the small area of potential impact and the low increase in SSC and sedimentation predicted, the value and sensitivity of the receptor is assessed as low, the magnitude of the impact is considered negligible and the significance of the effect is assessed as **Negligible** and **Not Significant**.

Release of contaminated sediments

18.8.39 Disturbance of the seabed during seabed preparation and submarine cable installation activities has the potential to release contaminants from the sediment where they can disperse. Site specific contaminant data indicates that almost all samples and contaminants were below Cefas CAL 1 levels and NOAA ERL levels, with the only exceedances being an exceedance of Cefas CAL 1 for arsenic at approximately 60% of the samples and one exceedance of NOAA ERL for mercury at a nearshore sample site (LL_11_EBS) with a value of 0.16mg/kg, compared to an ERL of 0.15mg/kg. The site-specific sample data is in line with sediment samples across the wider study area from a number of other studies and all concentrations, for all contaminants were below Cefas CAL 2 levels. The low concentrations indicate there is minimal risk to marine life and no significant environmental impact. The sediments are therefore considered suitable for seabed disposal and the risk of release of contaminants from the sediment is low.

18.8.40 While no direct measurements of nutrients in the sediments have been obtained, water samples from the Environment Agency's WIMS archive (Ref 15) analysed for DIN and orthophosphates indicate low nutrient levels (<1mg/l and 0.1mg/l, respectively) and levels of TOC in the sediment were in the normal expected range for the North Sea, indicating high nutrient levels within the seabed sediments are unlikely and the risk of release of nutrients from the sediment is low.

18.8.41 The value and sensitivity of the receptor is assessed as low and the magnitude of and the impact is assessed as negligible so that the significance of effect is assessed as **Negligible** and **Not Significant.**

Operation and maintenance

18.8.42 The Proposed Offshore Scheme would be designed to minimise any maintenance requirements. The following activities may be required during the operational phase:

a. inspection surveys;
b. cable Repair (if required); and
c. reburial, remedial protection, or maintenance and reinstatement of external cable protection features.

18.8.43 The associated impacts of operation and maintenance would be less than those experienced during the construction phase of the marine scheme.

18.8.44 The assessment of potential impacts on the marine physical environment associated from the operational phase is reported in the following subsections.

Changes to coastal morphology - Impact of future coastal erosion on the Proposed Scheme

18.8.45 A concern raised by stakeholders is whether the Proposed Scheme is sufficiently resilient that if coastal erosion occurs the HVDC Submarine Cables would not become exposed at the proposed Landfall. This is not an impact pathway of the Proposed Scheme on the marine physical environment rather the impact of the environment on the Proposed Scheme. As such, the information provided in this sub-section is provided for information to explain how the baseline conditions and future climate change predictions (as presented in this chapter of the PEIR) have been used to inform the design of the Proposed Scheme. It should be read in conjunction of **Chapter 2 Description of the Proposed Scheme** of this PEIR.

18.8.46 Several technical studies have been undertaken to inform the design and position of the transition joint bay and the design of the horizontal directional drill (in particular the length of the drill and ducts and the depth at which it would pass under key features such as the dune system at the proposed Landfall). The proposed position of the transition joint bay within the Proposed Onshore Scheme occupies an area of higher ground (circa 9m above ordnance datum) that is encircled by an area of high flood risk from combined fluvial (river) and coastal flooding. The Environment Agency has decided to 'hold the line' in the latest Shoreline Management Plan (Ref 32) and maintain the natural dunes at the shoreline. Erosion rates at present show a 0.5m per year accretion rate. However, under the climate change scenarios this is expected to change to an erosion rate of -1.7m per year under RCP8.5. Predicted shoreline change maps for 'with present management' show a retreat of the shoreline of 220m for 2105 (Ref 55). The transition joint bay is significantly landward of the predicted 2105 shoreline position, at 480m landward of present day MHWS.

18.8.47 Technical studies undertaken by the Applicant indicate that the HDD would be at a depth of 23 to 27m below the ground level, with a maximum depth of 30m below the natural sea defences (Ref 1). Bathymetry gradients across the

intertidal zone are approximately 1 in 100. Assuming the present-day beach gradient is maintained following shoreline retreat the vertical change in the surface following a 220m shoreline retreat would be of the order of 2m. As such the risk of cable exposure with shoreline retreat is assessed to be low, with the cable remaining far below the surface.

Preliminary assessment of the impact of the Proposed Scheme on coastal morphology

18.8.48 There would be no permanent surface infrastructure which could directly impact coastal morphology during the operation of the Proposed Scheme. In some cases, changes to offshore morphology (for example from addition of scour protection) could alter the tidal or wave conditions and result in indirect changes to coastal morphology.

18.8.49 The Proposed Offshore Scheme is expected to require up to 18 infrastructure crossings, the shallowest and most inshore of which are at KP11 and KP12 in water depths of approximately 22m. All other crossings are in deeper water of 32m to 48m. The most inshore location identified with hard substrate which could also require cable protection is around KP30 where water depths are approximately 35m to 40m.

18.8.50 Changes in bathymetry from cable protection would be small relative to the baseline water depths, with berm heights of 2.2m or less for infrastructure crossings and 1.5m or less for hard substrate. This represents less than a 10% change in areas where the Proposed Offshore Scheme crosses infrastructure. As such, changes are small relative to the overall water depth and are highly localised. Due to the small magnitude and localised nature of the changes in water depths, the addition of cable protection would not be expected to result in significant changes to the propagation of waves or flows from offshore to onshore and the potential for indirect changes to coastal morphology are not expected. Therefore, the value and sensitivity is assessed as low.

18.8.51 The magnitude of impact is assessed as negligible, and the significance of effect is assessed as **Negligible** and **Not Significant**.

Temporary habitat loss/seabed disturbance

18.8.52 Impacts from unforeseen maintenance of the cable would be of smaller magnitude when compared to impacts from construction, due to the isolated and targeted nature of the maintenance works.

18.8.53 Therefore, the sensitivity of changes to habitat and substrate is considered low, the magnitude is considered negligible, and the significance of effect is assessed as **Negligible** and **Not Significant.**

Temporary increases in suspended sediments and subsequent deposition

18.8.54 Impacts from unforeseen maintenance of the cable would be of smaller magnitude when compared to impacts from construction, due to the isolated and targeted nature of the maintenance works.

18.8.55 Increases in SSC at the Sizewell C intakes (which are not expected to be operational at the time of installation of the Proposed Offshore Scheme but would be during the operational stage of the Proposed Scheme) of up to 20 mg/l could occur for cable repair activities in the section of the cable between KP3 and KP10 if undertaken on flooding spring tides. The predicted increases in SSC at the intakes are short lived (around 3 hours or less) and the sediment in suspension would be comprised mainly of clay sized sediment particles and would therefore most likely remain in suspension within the cooling water system. Undertaking repairs on neap tides and/or the ebbing tide could mitigate the risk of increased SSC at the Sizewell C intakes if the estimated numbers raise operational concerns for the power station.

18.8.56 The value and sensitivity of increases in SSCs and subsequent changes to seabed level, is considered low.

18.8.57 The predicted increases in SSC and sedimentation are small in comparison to natural processes in the area; therefore, the magnitude of the impact is considered negligible, and the significance of the effect is assessed as **Negligible** and **Not Significant.**

Permanent habitat loss

18.8.58 The permanent loss of habitat from cable protection which would occur during construction would also be applicable during the operation and maintenance of the Proposed Offshore Scheme. There is also potential for additional habitat loss associated with scour around cable protection, due to the acceleration of flows around the cable protection. Areas most susceptible to scour are those of softer surficial sediments, shallower water depths and faster flows.

18.8.59 An assessment of sediment types, flow speeds and water depths at the infrastructure crossings for the Proposed Offshore Scheme indicate that the seabed is mobile under the action of peak spring tidal flows across much of the Draft Order Limits suggesting that there is the potential for some scour to occur around the berms. At the majority of infrastructure crossing locations, the cable is aligned close to parallel to the flow direction so that any berms would also be aligned approximately parallel to the flows, minimising the extent of any scour. Infrastructure crossings which are in areas where the cable is not parallel to the flow direction occur at the offshore end of the Draft Order Limits in an area of slower flows (reducing the potential for scour) and around KP37, KP47 and KP60. At these more inshore locations, the bed would be mobile under both spring and neap flows and there is greater potential for scour around berms in these areas.

18.8.60 Given the localised nature of cable protection and the localised potential for scour (which would be mitigated through embedded design measures – see **Table 18.15**) the value and sensitivity of the receptor is assessed as low. The impact is assessed as negligible, and the significance of effect is assessed as **Negligible** and **Not Significant**.

Transboundary impacts - temporary increases in suspended sediments and subsequent deposition

18.8.61 As for construction, the only potential for transboundary effects is due to cable repair works at the offshore end (between KP177 and KP180) of the Draft Order Limits where the Proposed Offshore Scheme transits into the Dutch EEZ. Any sediment plumes associated with cable repair during operation would be more localised than during installation and as a result would be shorter lived. As for construction, any increases in SSC would only occur close to the seabed and would be of low magnitude.

18.8.62 In view of the small area of potential impact and the low increase in SSC and sedimentation predicted, the value and sensitivity of the receptor is assessed as low, the magnitude of the impact is considered negligible and the significance of the effect is assessed as **Negligible** and **Not Significant**.

Temperature increase

18.8.63 During the operation of an Offshore HVDC submarine cable, heat losses occur because of the resistance in the cable/conductor. This can cause localised heating of the surrounding environment (i.e., sediment for buried cables, or water in the interstitial spaces of external cable protection). There are no specific regulatory limits applied to temperature changes in the seabed, although a 2°C change between seabed surface and 0.2m depth is used as a guideline in Germany (Ref 70). The benchmark for sensitivity used by Marine Evidence-based Sensitivity Assessment (MarESA) is a 5°C increase in temperature for one month, or 2°C for one year on the seabed surface.

18.8.64 The heat loss from the cable is related to the physical and thermal properties of the cables. **Appendix 2.4 Offshore Thermal Emissions Technical Note** of this PEIR presents a desk-based assessment comparing results from different projects which undertook modelling to evaluate the thermal performance of Offshore HVDC submarine cables for different scenarios (including directly buried in a bundle to differing depths and contained within a duct at various depths).

18.8.65 The study demonstrated that seabed temperatures at 0.5m immediately above the cables are estimated to be between 13 - 15°C warmer, with the cables operating at maximum operating temperatures, with burial assumed to be 1m. To reach these temperatures the system would have to operate at full load continuously for an extended period of time. The system would not be at full load for this long and therefore the temperature would fluctuate and be unlikely to

reach these maximums for extended periods. Although thermal effects would be long-term and occurring continuously for the operational lifetime of the Proposed Offshore Scheme, the temperature increase is low level and likely to be only 1 – 2°C higher than ambient temperatures (approximately 15°C) at the shallow sediment depths (<0.2m) at which infaunal species are typically found. The deeper the burial of the cables the lower the thermal changes in the shallower sediments.

18.8.66 The value and sensitivity of the receptor is assessed as low. Due to natural seasonal changes in water temperature, a sediment temperature change of a few degrees higher than ambient is regarded as an insignificant temperature increase. Coupled with the fact that temperature changes would be isolated to immediately above the cables, the magnitude of the impact on sediments has been assessed as negligible.

18.8.67 Therefore, the significance of effect of an increase in temperature on marine sediments is assessed as **Negligible** and **Not Significant.**

Decommissioning

18.8.68 The Proposed Scheme is expected to have a life span of 40 years. If decommissioning requires cessation of operation and removal of visible infrastructure at this point, then activities and effects associated with the decommissioning phase are expected to be no worse than during construction; and with the removal of visible infrastructure, effects would reduce over the course of that period. The Proposed Scheme could also remain operational for a period after the 40 years or be taken out of service and left within the Draft Order Limits after 40 years. Acknowledging the complexities of completing a detailed assessment for decommissioning works up to 40 years in the future, based on the information available, the project has concluded that impacts from decommissioning would be no greater than those during the construction phase. The following conclusions reached for construction are therefore applicable:

a. leaving the cable in situ, buried;
b. leaving the cable in situ with additional protection;
c. removing sections of the cable that present a risk; and
d. removing the entire cable.

18.8.69 A final decommissioning strategy would be determined closer to the end of life based on the latest available information and regulatory regime.

18.8.70 The effect of decommissioning on all marine physical environment receptors is expected to be of similar or smaller magnitude (with all assessed as negligible) than during construction and the value and sensitivity of the receptors within the Draft Order Limits is expected unchanged from during construction (all assessed as negligible or low) so that the significance of effects during decommissioning are predicted to be **Negligible** and **Not Significant**.

18.9 Mitigation, monitoring and enhancement

18.9.1 Mitigation measures are defined in **Chapter 5 EIA Approach and Methodology** of this PEIR, with embedded control measures for the marine physical environment being presented in **Section 18.7** of this chapter.

18.9.2 There are no likely significant adverse effects related to the marine physical environment assessment identified either during construction, operation and maintenance or decommissioning stages of the Proposed Scheme that require additional mitigation or monitoring.

18.10 Summary of residual effects

18.10.1 The preliminary assessment has concluded that no significant effects on the marine physical environment are expected from the Proposed Offshore Scheme alone during construction, operation and maintenance, and decommissioning, provided design and control measures are implemented. No additional mitigation has been proposed at this stage.

Topic Glossary and Abbreviations

Term	Definition
ARCMP	Anglian Regional Coastal Monitoring Programmes
ATT	Admiralty Total Tide
BEP	Best Environmental Practice
BERR	Business Enterprise and Regulatory Reform
BGS	British Geological Survey
BODC	British Oceanographic Data Centre
CAL	Cefas Action Level
CBRA	Cable Burial Risk Assessment
CCO	Channel Coastal Observatory
CEMP	Construction Environmental Management Plan
CERA	Coastal Erosion Risk Assessment
CFE	Controlled Flow Excavator
CFSR	Climate System Forecast Reanalysis
CPA	Coast Protection Act
CPT	Cone Penetrometer Test
CSEMP	Clean Safe Seas Environmental Monitoring Programme
DBT	Dibutyltin
DCO	Development Consent Order
DIN	Dissolved Inorganic Nitrogen
DoL	Depth of Lowering
EA	Environment Agency
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMODnet	European Marine Observation and Data Network
EOX	Extractable Organic Halogens
ERL	Effect Range Low
ERM	Effect Range Median
ES	Environmental Statement
ESC	East Sussex Council
FEPA	Food and Environmental Protection Act
GC	Gas Chromatography

Term	Definition
GN	Guidance Note
HAT	Highest Astronomical Tide
HDD	Horizontal Directional Dredging
HVDC	High Voltage Direct Current
HYCOM	Hybrid Coordinate Ocean Model
JNCC	Joint Nature Conservation Committee
KP	Kilometre Point
LAT	Lowest Astronomical Tide
MarESA	Marine Evidence-based Assessment
MARPOL	International Convention for the Prevention of Pollution from Ships
MCZ	Marine Conservation Zone
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MMO	Marine Management Organisation
MPCP	Marine Pollution Contingency Plan
MSFD	Marine Strategy Framework Directive
MSL	Mean Sea Level
NE	Natural England
NOAA	National Oceanic and Atmospheric Administration
NPS	National Policy Statement
NRW	Natural Resources Wales
NTSLF	National Tide and Sea Level Facility
OCP	Organochlorine Pesticides
ONR	Office for Nuclear Regulation
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
OWF	Offshore Wind Farm
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated biphenyls
PEIR	Preliminary Environmental Information Report
PLONOR	pose little or no risk
PSA	Particle Size Analysis
RCP	Representative Concentration Pathways
RMDOL	Recommended Minimum Depth of Lowering
RNAG	The Reason For Not Achieving Good

Term	Definition
SAC	Special Area of Conservation
SMP	Shoreline Management Plan
SNS	Southern North Sea
SPA	Special Protection Area
SPM	Suspended Particulate Matter
SSC	Suspended Sediment Concentration
SSSI	Sites of Special Scientific Interest
TBT	Tributyltin
TDOL	Target Depth of Lowering
THC	Total Hydrocarbon Content
TOC	Total Organic Carbon
TOM	Total Organic Matter
TSHD	Trailing Suction Hopper Dredger
UKCP	UK Climate Change Projections
UKHO	UK Hydrographic Office
UKOOA	United Kingdom Offshore Operators Association
UXO	Unexploded Ordnance
WFD	Water Framework Directive
WW3	Wavewatch III

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