Preliminary Environmental Information Report Volume 1

Chapter 2 Description of the Proposed Scheme

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Contents

Glossary of Project Terminology

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

Terms and abbreviations contained herein are provided at the end of the document in the **Topic Glossary and Abbreviations.**

Term	Description
Amendment to Kiln Lane Substation Scenario	The scenario where the Proposed Scheme will comprise the amendments to Kiln Lane Substation that would be required if Kiln Lane Substation was built out pursuant to the EA1N/EA2 DCOs.
Applicant, the	National Grid Lion Link Limited (NGLLL)
Bellmouth	A flared vehicular access/egress point connecting permanent route to the public highway.
Converter Station	A converter station changes electricity between High Voltage Alternating Current (HVAC), which power our homes, and High Voltage Direct Current (HVDC) which is more efficient for transporting electricity over long distances and vice versa. The proposed Converter Station is located to the east of Saxmundham.
Converter Station Site	The Converter Station Site as a whole, allowing for the co-location of the Converter Station with the Converter Station being separately consented as part of the Sea Link project.
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.
Construction Compound	Temporary compounds installed during the construction phase of the Proposed Scheme. Each compound is likely to contain storage areas such as laydown areas, soils storage, and areas for equipment and fuel, drainage, generators, car parking and offices and welfare areas (portacabins).
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

Term	Description
	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.
Eastern Route Option	As part of the Underground HVDC cable corridor, the Eastern Route Option would facilitate a degree of co-location with the Sizewell Link Road (SLR) scheme.
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 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.
Full Build Out of Kiln Lane Substation Scenario	The scenario if the Proposed Scheme was brought forward first, then it would be responsible for developing Kiln Lane Substation for the Proposed Scheme, with sufficient additional capacity for other projects.
Joint Bay	Underground structures constructed at regular intervals along the onshore cable route to join sections of cable and facilitate installation of the cables into the buried ducts.
Kiln Lane Substation	The proposed connection point for the Project to the British National Electricity Transmission System, located to the north of Friston. Formerly known as Friston Substation. The new name has recently been adopted by NGET. The substation is of the same footprint and in the same location. Friston Substation will, hereafter, be referred to as Kiln Lane Substation.
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.

Term	Description
Limit of Deviation	A maximum distance or measurement of variation within which the works must be constructed. These are lateral (i.e. on the ground) and vertical limits (in relation to height).
Link Box Chamber	Link boxes are used at joint bays to facilitate grounding connections to ensure safety and enable maintenance. Link boxes can either be installed below ground, in a link box chamber, or in an above ground link pillar
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 Electricity Distribution (NGED)	The local distribution network operator for the Midlands, the southwest of England and south Wales.
National Grid Electricity Transmission (NGET)	Operators of the national electricity transmission network across Great Britain and own and maintain the network in England and Wales, providing electricity supplies from generating stations to local distribution companies. National Grid does not distribute electricity to individual premises, but its role in the wholesale market is vital to ensuring a reliable, secure and quality supply to all.
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 Strategic Infrastructure (NGSI)	Part of NGET and responsible for delivering major strategic UK electricity transmission projects, focussed on connecting more clean, low-carbon power to England and Wales.
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.
Non-standard interconnector (NSI)	A project where GB interconnection is combined with transmission of offshore generation outside of GB.
Northern Route Option	A northern cable corridor option that would allow Underground HVAC Cable delivery for Proposed Scheme only.
Offshore Hybrid Asset (OHA)	A project that combines cross-border interconnection with the transmission of offshore generation, this is an overarching term which covers both multi-purpose interconnectors (MPI) and non-standard interconnectors (NSI).

Term	Description
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.
Overhead Lines (OHL)	Conductors (wires) carrying electric current, strung from Tower to Tower.
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 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.

Term	Description
Proposed Onshore Scheme	The term used when referring to the onshore elements of the Proposed Scheme, landward of the mean low water springs. Proposed Onshore Scheme components include: a) Kiln Lane Substation. b) Underground High Voltage Alternating Current (HVAC) Cables; c) Converter Station. d) Underground High Voltage Direct Current (HVDC) Cables; and e) Landfall.
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.
Rochdale Envelope	The Rochdale Envelope or Design Envelope approach is employed where the nature of a proposed development means that some details of a project are not available in advance of, or at the time of submitting the DCO application. The Rochdale Envelope approach defines a design envelope and parameters within which the final design will sit and ensures a robust and reliable EIA can be undertaken.
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: a) The East Anglia ONE North Offshore Wind Farm Order 2022; and b) East Anglia TWO Offshore Wind Farm Order 2022
Southern Route Option	A southern cable corridor option that would allow: a) Underground HVAC Cable delivery for Proposed Scheme only, or b) Underground HVAC Cable delivery for Proposed Scheme and ducting for Sea Links Underground HVAC and HVDC cables in that section.

Term	Description
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.
Substation	Substations are used to control the flow of power through the electricity system. They are also used to change (or transform) the voltage from a higher to lower voltage to allow it to be transmitted to local homes and businesses.
TenneT	Operator of the electricity transmission network across the Netherlands.
Tower	A structure used to carry overhead electrical conductors, insulators, and fittings. Often described as a pylon.
Transition Joint Bay (TJB)	An underground structure at the Landfall Site that house the joints between the offshore cables and the onshore cables.
Underground Cable Corridors	Collective term for the corridors within which HVAC and HVDC cables are planned.
Underground High Voltage Alternating Current (HVAC) Cable Corridor	A corridor in which the underground HVAC cables are planned to be installed.
Underground High Voltage Alternating Current (HVAC) Cables	Transmission cables which connect between the Converter Station and Substation. HVAC cables are designed to manage fluctuating flow of current.
Underground High Voltage Direct Current (HVDC) Cable Corridor	A corridor in which the underground HVDC cables are planned to be installed.
Underground High Voltage Direct Current (HVDC) Cables	Transmission cables which connect the Converter Station to the Landfall Site and then offshore. HVDC cables are designed to manage current flowing in one direction.
Visibility Splay	An area of land at a road junction that ensures drivers have an unobstructed view of oncoming traffic allowing them to safely join or cross the road.
Western Route Option	As part of the Underground HVDC cable corridor, the Western Route Option would deliver the Scheme within its own corridor with no co-location with the Sizewell Link Road (SLR) scheme.

2 Description of the Proposed Scheme

2.1 Introduction

2.1.1 This chapter describes the Great Britain (GB) components of the LionLink Project (hereafter referred to as the 'Proposed Scheme') which will comprise the application for development consent, and on which the Environmental Impact Assessment (EIA) is based, as reported in this Preliminary Environmental Information Report (PEIR).

2.1.2 The Proposed Scheme is characterised by:

a. Kiln Lane Substation;
b. Proposed Underground High Voltage Alternating Current (HVAC) Cables between Kiln Lane Substation and the proposed Converter Station;
c. Proposed Converter Station;
d. Proposed Underground High Voltage Direct Current (HVDC) Cables between the proposed Converter Station east of Saxmundham, and the Landfall Site at Walberswick;
e. Proposed Landfall Site at Walberswick;
f. Proposed Offshore High Voltage Direct Current (HVDC) Cables from the proposed Landfall Site at Walberswick at the UK coast, to the edge of the UK Exclusive Economic Zone (EEZ); and
g. Associated enabling works, construction activities and temporary land take to deliver the Proposed Scheme; and
h. Required landscaping, drainage and environmental mitigation measures.

2.1.3 This chapter provides a description of the Proposed Scheme's principal components and an outline of construction, operation and maintenance, and decommissioning activities. It is anticipated this description of the Proposed Scheme will evolve for the Environmental Statement (ES) following design refinement, further to consideration of feedback received during the Statutory Consultation.

2.1.4 This chapter is supported by the following Appendices and Figures:

a. **Appendix 2.1 Outline Onshore Code of Construction Practice;**
b. **Appendix 2.2 Outline Offshore Construction Environmental Management Plan;**
c. **Appendix 2.3 Electromagnetic Field Assessment;**
d. **Appendix 2.4 Offshore Thermal Emissions Technical Note;**
e. **Appendix 2.5 Outline Cable Burial Risk Assessment;**
f. **Figure 1.1 Location Plan;**
g. **Figure 1.2 Proposed Onshore Scheme Draft Order Limits;**
h. **Figure 1.3 Proposed Offshore Scheme Draft Order Limits;**
i. **Figure 2.1 Zoning Plan;**
j. **Figure 2.2 Proposed Onshore Scheme;**

k. **Figure 2.3 Proposed Onshore Scheme Crossing Points;**
l. **Figure 2.4 Proposed Offshore Scheme;**
m. **Figure 2.5a to f Proposed Offshore Scheme KP 0 to KP 180;**
n. **Figure 2.6 Sand wave pre-sweeping and disposal areas within Proposed Offshore Scheme;**
o. **Figure 2.7 Infrastructure crossings within Proposed Offshore Scheme; and**
p. **Figure 2.8 Horizontal Directional Drilling Cable Landfall.**

2.1.5 For ease of presentation, the Proposed Scheme has been split geographically into the Proposed Onshore Scheme and Proposed Offshore Scheme. The sections which follow describe the infrastructure proposed in each of these areas:

a. **Section 2.2 Overview of the Proposed Scheme** which describes at a high level the components of the Proposed Onshore Scheme and Proposed Offshore Scheme;
b. **Section 2.3 Proposed Onshore Scheme** provides greater detail of the components of the Proposed Onshore Scheme;
c. **Section 2.4 Proposed Offshore Scheme** provides greater detail of the components of the Proposed Offshore Scheme;
d. **Section 2.5 Indicative construction activities** provides the likely activities required to deliver both the Proposed Onshore and Offshore Schemes;
e. **Section 2.6 Indicative operation and maintenance activities** provides the likely operational and maintenance regimes of the Proposed Onshore and Offshore Schemes; and
f. **Section 2.7 Indicative decommissioning activities** provides the likely activities required to de-energise, deconstruct and reinstate (as may be required) areas affected by the Proposed Scheme.

Development Consent Order Limits

2.1.6 Order Limits represent the extent of the area within which a project authorised by development consent may be carried out, including the required permanent and temporary land needed for construction, operation and maintenance, and decommissioning activities. The Order Limits will be shown on the works plans submitted with the DCO application.

2.1.7 This PEIR is based on Draft Order Limits (DOL), as shown in **Figures 1.1, 1.2** and **1.3**, of this PEIR. For the purposes of this PEIR, these DOL have been drawn to provide flexibility to allow for further refinement of the scheme design and development further to detailed design and feedback from statutory consultation.

2.1.8 For the purposes of the assessment within the PEIR, the Applicant has followed the ‘Rochdale Envelope’ approach (in accordance with Planning Inspectorate Advice Note Nine: Rochdale Envelope (Ref 1)). This is set out further in **Chapter 5 EIA Approach and Methodology** of this PEIR.

2.1.9 Following the Statutory Consultation on the Proposed Scheme, further scheme design and development will be undertaken. This will have regard to further environmental surveys and assessments as well as consultation feedback.

2.1.10 As part of the iterative design process of the Proposed Scheme and the increased understanding of the specific requirements for environmental mitigation or compensation that will arise out of technical assessments, the DOL may also be refined or amended following the Statutory Consultation. Wherever, possible such mitigation requirements will be met within the DOL as presented in this PEIR.

Parameters and Limits of Deviation

2.1.11 Within the DOL, Limits of Deviation (LoD) will be defined. This PEIR is based on draft LoD (the lateral LoD is illustrated in **Figure 2.2** of this PEIR) which define the extent of the area within which the operational elements of the Proposed Scheme would be located and within which they may deviate spatially (both horizontally and vertically). This provides the required level of flexibility necessary to ensure deliverability and allow for unknowns that would not arise until the post-consent detailed design and construction stages.

2.1.12 The assessment within this PEIR is also based on parameters to inform the assessment of the Proposed Scheme and identified associated development including construction compounds, for example, in order to inform a robust assessment and ensure that a realistic 'worst-case' design envelope informs this assessment.

2.1.13 An assessment of the likely significant effects has not been undertaken on a defined cable location, as the cables could be located anywhere within the draft LoD for the cable corridor. The PEIR assessments have been undertaken considering the likely worst-case location of the cable within the draft LoD for the cable based on a variety of receptors, which are detailed throughout the technical topic chapters to this PEIR.

2.1.14 The application for development consent will be based on a preliminary design, with the final detailed design to be refined by the Applicant and the relevant appointed contractor post-consent – noting that any such refinement will be within the maximum design parameters which are assessed in the final Environmental Statement, and secured through the DCO. The final design, delivered by the contractor (as appointed by the Applicant), will be in accordance with the maximum design parameters which are assessed in the final Environmental Statement and various controls secured through the DCO.

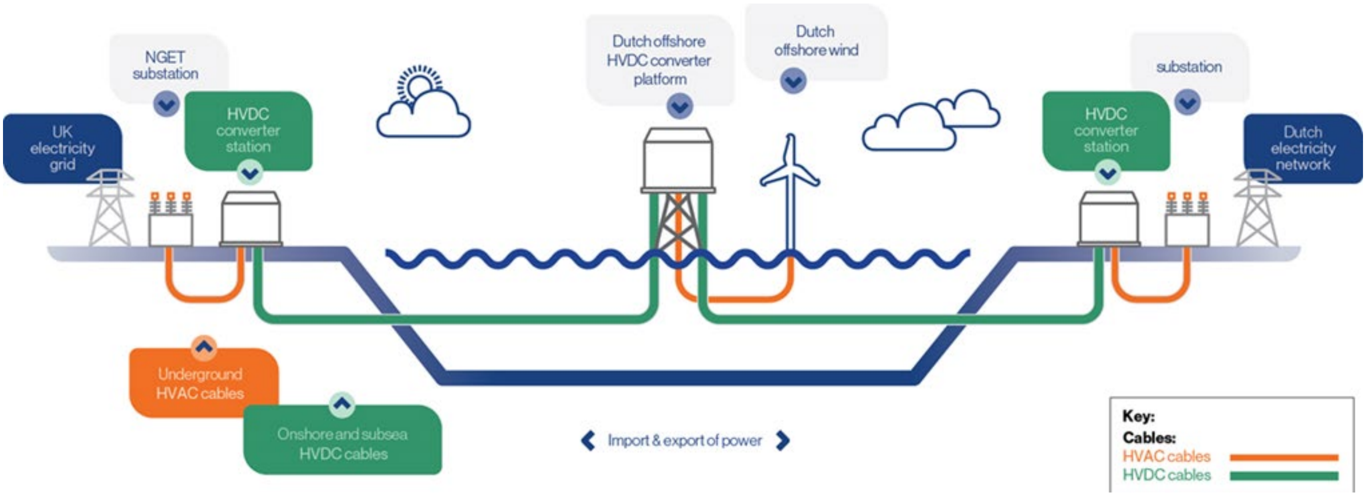
2.2 Overview of the Proposed Scheme

2.2.1 The Project comprises a new interconnector with a capacity of up to 2.0 gigawatts (GW) between the National Electricity Transmission Systems (NETS) of GB and the Netherlands, including a connection into a wind farm located in Dutch waters.

2.2.2 Interconnectors connect the NETS of at least two countries to each other, and in some instances may include a connection to offshore power generation such as wind farms – where such an additional connection forms part of the development, this is known as an 'Offshore Hybrid Asset'. For this Project, the route of the Offshore electricity cables is from a grid connection point in the vicinity of the Suffolk coast, UK, to the coast near Rotterdam in the Netherlands, with a connection to the Ijmuiden Ver and Nederwiek windfarm zones located in Dutch waters.

2.2.3 This overview of the Project is illustrated in **Inset 2.1.**

Inset 2.1: Key components of the Project



2.2.4 The Proposed Scheme consists of the GB components only, which will comprise the application for development consent.

2.2.5 The key infrastructural components of the Proposed Scheme are illustrated in **Figure 2.1** of this PEIR and comprise:

a. Kiln Lane Substation;
b. Proposed Underground HVAC Cables between Kiln Lane Substation and the proposed Converter Station;
c. Proposed Converter Station;
d. Proposed Underground HVDC Cables between the proposed Converter Station east of Saxmundham, and a proposed Landfall Site at Walberswick;
e. Proposed Landfall Site at Walberswick; and
f. Proposed Offshore HVDC Cables from the proposed Landfall Site at Walberswick at the UK coast, to the edge of the UK EEZ.

Coordination with other onshore projects

2.2.6 A number of energy infrastructure projects are proposed in the same locality to the Proposed Onshore Scheme. To acknowledge feedback received during non-statutory consultation and within the **EIA Scoping Opinion** (Ref 2), opportunities for coordination with other projects have been explored.

2.2.7 Nationally Significant Infrastructure Projects identified in the locality of the Proposed Scheme have included:

a. East Anglia ONE North (EA1N) Offshore Wind Farm Order 2022 and The East Anglia TWO (EA2) Offshore Wind Farm Order 2022 being promoted by Scottish Power Renewables (SPR).
b. Sea Link application 2025 (Planning Inspectorate Reference EN020026), being promoted by National Grid Electricity Transmission (NGET); and
c. Sizewell C (Nuclear Generating Station) Order 2022, which was consented by NNB Generation Company (SZC) Limited.

2.2.8 Coordination opportunities sought included the sharing of site survey information and data, co-locating infrastructure and exploring the potential for coordination of the physical delivery of infrastructure. The feasibility and deliverability of coordination is still being explored, based on current known information about other proposed projects, and the Applicant will continue to engage with other developers to ensure that the benefits of coordination can be realised where possible.

2.2.9 The description of the Proposed Onshore Scheme in the following sections includes a description of the Proposed Scheme in isolation, and where relevant, a description of where coordination could take place.

2.2.10 Further detail of the design evolution process is provided in **Chapter 3 Alternatives and Design Evolution** of this PEIR.

Kiln Lane Substation

2.2.11 Kiln Lane Substation has already been consented as part of other third-party Development Consent Orders, specifically the SPR EA1N and EA2 Consents. It is anticipated that Kiln Lane Substation will be delivered under the extant SPR EA1N and EA2 Consents by 2028.

2.2.12 The Proposed Scheme proposes a connection to the existing transmission network via the National Grid element of the consented Kiln Lane Substation. The Kiln Lane Substation as consented by SPR does not include sufficient connection capacity for the Proposed Scheme, therefore in order to facilitate connection of the Proposed Scheme some additional extension works would be required at the Kiln Lane Substation.

2.2.13 However, in order to account for the unlikely scenario that the Kiln Lane Substation is not delivered by the SPR consent(s), and to avoid the Proposed Scheme being reliant on third party works which are yet to be implemented, the Applicant will seek to consent delivery of the Kiln Lane Substation in its entirety as an alternate consenting scenario. in order to safeguard the future connection requirements of the Proposed Scheme. Consenting scenarios are further described in **Section 5.6** of **Chapter 5 EIA Approach and Methodology** of this PEIR.

Sea Link

2.2.14 NGET submitted its DCO application for the Sea Link project in March 2025, and this was accepted for examination on 23 April 2025 by the Planning Inspectorate. The Sea Link project is a ‘bootstrap’ transmission project between Suffolk and Kent, which seeks to reinforce the electricity transmission system. Within its proposals is a cable route between the proposed Kiln Lane Substation and a converter station which has been co-located with the proposed Converter Station for the Proposed Scheme. An opportunity has been identified to also coordinate the delivery of the Proposed Scheme’s Underground HVAC Cable within the same proposed Sea Link cable corridor, which the Applicant is exploring with NGET and which is accounted for within this PEIR.

Sizewell C and Sizewell Link Road

2.2.15 The Sizewell C project benefits from development consent granted in 2022. One of the components of the Sizewell C proposals is a new road (referred to as the Sizewell Link Road (SLR)) connecting the A12 near Yoxford with the B1122 approximately 5.5 kilometres (km) to the east, bypassing the villages of Yoxford, Middleton Moor, and Theberton. A coordination opportunity has been identified for the proposed Underground HVDC Cable Corridor in the vicinity of Theberton and Annesons Corner where the Proposed Scheme has the opportunity to align its proposed Underground HVDC Cable Corridor with the proposed SLR route – this is accounted for this PEIR.

Coordination with other offshore projects

2.2.16 No coordination opportunities have been identified between the Proposed Offshore Scheme and other offshore projects within GB waters.

Onshore consenting scenarios and optionality

2.2.17 At this time, there are a number of ways that the Kiln Lane Substation, the proposed Underground HVAC Cable Corridor, and the proposed Underground HVDC Corridor may be delivered due to ongoing coordination with third party projects which are being brought forward within the same locale. Therefore, this PEIR has considered possible alternative consenting scenarios, and some potential optionality within some of these scenarios, in order to retain the necessary flexibility at this stage. For the avoidance of doubt, there are not multiple consenting scenarios, or any optionality, in relation to the proposed Converter Station or the proposed Landfall.

2.2.18 In order to ensure a robust assessment in light of these scenarios and associated options, each chapter within this PEIR has set out what the worst-case scenarios and options (as appropriate) are in relation to the relevant topic, and has undertaken its environmental assessment on that basis. This ensures that the realistic worst-case impacts for each topic have been assessed and provides for the most robust assessment methodology.

The consenting scenarios and options which are considered for the purposes of this PEIR are set out in detail in the subsection below, and within **Section 5.6** of **Chapter 5**.

Kiln Lane Substation Scenarios

2.2.19 At this time, there are two potential consenting scenarios for the Kiln Lane Substation within the Proposed Scheme.

2.2.20 The current position is that there could be up to four projects, including the Proposed Scheme, potentially connecting to the NETS at Kiln Lane Substation:

a. EA1N and EA2 Offshore Windfarm projects, being promoted by SPR, which have been granted consent;
b. Sea Link electricity network reinforcement project, being promoted by NGET; and
c. The Proposed Scheme.

2.2.21 The Kiln Lane Substation was consented by the 'EA1N Offshore Wind Farm Order 2022' and 'EA2 Offshore Wind Farm Order 2022'. Within these existing DCOs, the completed substation would include sufficient capacity for Sea Link's connections however there will not be sufficient connection capacity to account for the Proposed Scheme. In order to accommodate the Proposed Scheme, two new 400 kilovolt (kV) bays would need to be added to the Kiln Lane Substation, if built out pursuant to these existing EA1N and EA2 DCOs.

2.2.22 It is likely that the Kiln Lane Substation would be constructed pursuant to the EA1N/EA2 consents, and the Proposed Scheme would provide for the necessary changes to the Kiln Lane Substation in order to facilitate its connection.

2.2.23 However, there is a scenario where the Proposed Scheme is delivered without the Kiln Lane Substation first being developed by a third party. On the basis that the Kiln Lane Substation is essential infrastructure for the Proposed Scheme, the DCO Application for the Proposed Scheme will also seek to consent a full build-out of the Kiln Lane Substation by the Applicant.

2.2.24 This PEIR therefore presents the following two consenting scenarios, with separate sets of characteristics and parameters for Kiln Lane Substation, as follows:

a. Amendment to Kiln Lane Substation Scenario – which will comprise the amendments to Kiln Lane Substation that would be required if Kiln Lane Substation was first built out pursuant to the EA1N/EA2 DCOs. The characteristics and parameters for this scenario are presented in **Table 2.1**.
b. Proposed Full Build Out of Kiln Lane Substation – if the Proposed Scheme was brought forward first, then it would be responsible for developing Kiln Lane Substation for the Proposed Scheme, with sufficient additional capacity for other projects. The characteristics and parameters for this scenario are presented in **Table 2.2.**

Proposed Underground HVAC Cable Corridor

2.2.25 The proposed Underground HVAC Cable Corridor is located in Section A (**Figure 2.1**).

2.2.26 There are two consenting scenarios which are being progressed as part of the Proposed Onshore Scheme for the proposed Underground HVAC Cable Corridor:

a. Proposed Scheme only - The Proposed Onshore Scheme would consent and install Underground HVAC Cables for this Proposed Scheme only.
b. Proposed Scheme in coordination with Sea Link - The Proposed Onshore Scheme would install the ducting and cabling for the Proposed Onshore Scheme, and would also install ducting for Sea Link's HVAC and HVDC cabling. This would allow for coordination and colocation of the Proposed Onshore Scheme with Sea Link project.

2.2.27 There are two potential route options for the proposed Underground HVAC Cable Corridor – a Southern Route Option and a Northern Route Option (**see Figure 2.2**).

2.2.28 The Southern Route Option heads northwest from the Kiln Lane Substation and passes between Red House Farm and High House, co-locating within the proposed Sea Link HVAC and HVDC Cable Corridors. The route heads northwest from the Kiln Lane Substation, crossing agricultural farmed fields before reaching the proposed Converter Station.

2.2.29 The Northern Route Option crosses through agricultural fields between Little Moor Farm and Fristonmoor, routeing under the B1119 Saxmundham Road to the north, through agricultural fields in a westerly direction, before crossing under the B1119 Saxmundham Road for a second time, to head southwest entering the proposed Converter Station.

2.2.30 In relation to the Proposed Scheme in coordination with Sea Link scenario, this can only occur within the Southern Route Option due to the scope of the Sea Link consent in respect of where they have sought permission to install their cabling.

2.2.31 In relation to the Proposed Scheme only scenario, this PEIR assesses the Northern Route Option. This is because the 'worst-case' is already assessed in relation to the Southern Route Option, through assessment of the Proposed Scheme in coordination with Sea Link scenario at this route location.

Proposed Converter Station

2.2.32 There is one consenting scenario being considered for the proposed Converter Station component of the Proposed Scheme, and there is no optionality in relation to its siting.

2.2.33 The Proposed Onshore Scheme has sought to co-locate with Sea Link, who are proposing a converter station at the same locale. Colocation has involved coordination with Sea Link so that the two converter stations are located on adjacent sites in the same locality. However, for the avoidance of doubt, the Sea Link converter station would not form part of the Proposed Scheme. Therefore, the characteristics set out in this PEIR for the proposed Converter Station are for this Proposed Scheme only.

2.2.34 An assessment of the cumulative effects of the Proposed Scheme and Sea Link delivery in vicinity of each other will be provided within **Chapter 28 Cumulative Effects** of the ES.

Proposed Underground HVDC Cable Corridor

2.2.35 The proposed Underground HVDC Cable Corridor is located in Sections B to D of the DOL (as set out in **Figure 2.1**).

2.2.36 There is one consenting scenario presented for this component of the Proposed Onshore Scheme, which is the Applicant's proposal. There are two potential route options within Section B of the Underground HVDC Cable Corridor. These are referred to as the Western Route Option and the Eastern Route Option.

2.2.37 The Eastern Route Option would facilitate a degree of co-location with the SLR scheme.

Proposed Landfall

2.2.38 There is one consenting scenario for the proposed Landfall component, and no siting optionality to consider therein.

Proposed Offshore HVDC Cable Corridor

2.2.39 There is one consenting scenario for the proposed Offshore HVDC Cable Corridor, proposed by the Applicant.

2.2.40 The proposed Offshore HVDC Cable Corridor optionality being considered within this PEIR for the Proposed Offshore Scheme is:

a. A proposed Offshore HVDC Cable Corridor that crosses through the southwestern corner of Marine Aggregate Option Area 2109; and
b. A proposed Offshore HVDC Cable Corridor that avoids interaction with Marine Aggregate Option Area 2109.

2.3 Proposed Onshore Scheme

Proposed Onshore Scheme description

2.3.1 The Proposed Onshore Scheme illustrated on **Figure 2.2** of this PEIR comprises:

a. Kiln Lane Substation;
b. Proposed Underground HVAC Cable Corridor;
c. Proposed Converter Station;
d. Proposed Underground HVDC Cable Corridor; and
e. Proposed Landfall.

2.3.2 Due to the length of the proposed Underground Cable Corridor, sectioning has been used to describe the routes more clearly (Sections A to D) which are shown in **Figure 2.1** of this PEIR.

Kiln Lane Substation

2.3.3 Kiln Lane Substation is the proposed connection point for the Proposed Scheme into the GB NETS. Its location is illustrated on **Figure 2.2**.

Site and surroundings

2.3.4 The proposed Kiln Lane Substation is located to the north of the village of Friston, Suffolk.

2.3.5 The site is in a rural setting and is currently within farmed agricultural land with no direct road access to the site and one Public Right of Way (PRoW) crossing the site directly in a north-south direction. There are several residential properties to the north, the nearest is approximately 250m. There are several woodland blocks in the surrounding area, the nearest is Grove Wood ancient woodland which is approximately 350m to the southeast. There are existing overhead lines that intersects the site in a northeasterly direction. The site is approximately 1.7km north of the Suffolk & Essex Coast & Heaths National Landscape.

Description

Amendments to Kiln Lane Substation Scenario

2.3.6 If Kiln Lane Substation is constructed by NGET in accordance with the SPR EA1N/EA2 consents, amendments to Kiln Lane Substation would be required in order to accommodate the connection of the Proposed Scheme. The works required to amend Kiln Lane Substation would comprise:

a. an extension to the boundary of the site and installation of new boundary fencing and landscaping;
b. an extension of the Gas Insulated Switchgear (GIS) hall by up to 18m laterally, including associated foundation and structural steelwork, and civil ground works and other mitigation such as drainage;
c. the installation of two distributed relay rooms;
d. the installation of two new GIS bays located within the extension of the GIS building and outdoor 400kV Air Insulated Switchgear (AIS) equipment and Gas Insulated Busbar (GIB) for the connection of the proposed Underground HVAC Cables; and
e. the installation of additional indoor equipment including GIS switchgear, control and protection panels, telecommunication panels and associated Low Voltage (LV) cabling.

2.3.7 It is assumed that the existing battery chargers and Alternate Current (AC)/Direct Current (DC) distribution boards have the capacity to connect the required new connection bays.

2.3.8 In this scenario, Kiln Lane Substation could be fully operational under NGET Safety Rules and hence any substation extension works would involve necessary outage plans and staged work approaches to be agreed with NGET.

Characteristics

2.3.9 The characteristics and parameters that have informed the preliminary assessment are described in **Table 2.1.**

Table 2.1: Characteristics of the Amendments to Kiln Lane Substation Scenario

Characteristic	Parameter
Permanent extension footprint*	Up to 0.4ha
Maximum no. of new buildings	Two
Finished ground level	18.2m AOD
Building height	Extension of the GIS hall with a vertical height of up to 16m above finished ground level, in line with the Kiln Lane Substation design height in EA1N/EA2 DCOs.
Building width	Extension of the GIS hall by 18m laterally.
External electrical equipment height	8.5m

*this does not include land that may be determined to be required for potential mitigation following further assessment.

Permanent access

2.3.10 It is assumed that in advance of the Proposed Scheme commencing development, permanent access would be installed as part of the SPR EA1N/EA2 projects from the B1121, and no highway works are required to accommodate the proposed Amendments to Kiln Lane Substation Scenario.

Overhead Line works

2.3.11 It is assumed that in advance of the Proposed Scheme commencing development, OHL works would be completed as part of the SPR EA1N/EA2 projects.

2.3.12 No additional OHL works required to accommodate the Proposed Scheme.

Drainage

2.3.13 It is assumed that in advance of the Proposed Scheme commencing development, drainage would be installed as part of the SPR EA1N and EA2 Consents.

2.3.14 Minor amendments to the existing drainage design may be required to accommodate the extra bays which will be confirmed as the design detail progresses. The updated drainage design would be assessed as part of the ES and provided as part of the DCO submission.

Appearance

2.3.15 The Proposed Scheme extension areas to the Kiln Lane Substation would be consistent with SPR design principles.

Lighting

2.3.16 It is assumed that in advance of the Proposed Scheme commencing development, operational lighting would be installed as part of the SPR EA1N and EA2 Consents.

2.3.17 Additional lighting may be required for the extra bays, which will align with lighting principles approved as part of the SPR EA1N and EA2 Consents - this will be accounted for as part of the ES.

2.3.18 No additional lighting is proposed along the permanent access road.

Mitigation planting

2.3.19 It is assumed that in advance of the Proposed Scheme commencing development, planting would be installed as part of the SPR EA1N and EA2 Consents.

2.3.20 Should amendments to planting as consented within the SPR EA1N and EA2 Consents

2.3.21 be required to accommodate the extra bays, remedial planting will be consistent with SPR planting mitigation principles. This will be accounted for as part of the ES.

Limits of Deviation

2.3.22 The LoD is illustrated in **Figure 2.2** of this PEIR. The extent of the lateral LoD allows for the necessary flexibility for the design process to continue to develop so that the most suitable position for amendment to Kiln Lane Substation can be delivered.

Proposed Full Build Out of Kiln Lane Substation Scenario

2.3.23 If Kiln Lane Substation is not delivered pursuant to the SPR EA1N and EA2 Consents, Kiln Lane Substation would be delivered in its entirety pursuant to the DCO as granted for the Proposed Scheme. The characteristics described within this scenario are aligned with the SPR EA1N and EA2 Consents.

2.3.24 The works would comprise:

a. construction of a new GIS substation which would connect to the existing 400kV overhead lines (Bramford to Sizewell circuits 1 and 4) including associated civil ground works such as level platform and drainage;
b. removal of one OHL tower and installation of two new towers to turn circuits into the new substation. During construction, temporary towers and/or masts would be used to facilitate the reconfiguration of the OHL connections. No OHL works are required for any other part of the Proposed Onshore Scheme, with this work limited to the vicinity of Kiln Lane Substation;

c. construction of a substation access road; and
d. associated mitigation (including Biodiversity Net Gain (BNG) requirements) and landscaping.

Characteristics

2.3.25 The characteristics and parameters that have informed the preliminary assessment are described in **Table 2.2**.

Table 2.2: Characteristics of Proposed Full Build Out of Kiln Lane Substation Scenario

Characteristics	Parameter
Permanent footprint*	Up to 2.1ha
Finished ground level	18.2m AOD
Maximum no. of new buildings	1 main building (substation), with 8 associated buildings
Building height	Up to 16m (substation), up to 5m (associated buildings) above the finished ground level.
External electrical equipment height	15m

*this does not include land that may be determined to be required for potential mitigation following further assessment.

Permanent access

2.3.26 A new permanent access road and associated infrastructure (drainage, signage and fencing) would be installed from the B1121 to the west of the proposed Kiln Lane Substation site.

Overhead line works

2.3.27 The construction of the substation in the proposed Full Build Out of Kiln Lane Substation Scenario would also require modification works to the adjacent existing 4ZW 400 kV overhead line route to accommodate a double circuit turn in and out of the proposed Kiln Lane Substation. This would involve removal of one existing 4ZW 400 kV overhead line tower (4ZW020), and installation of two new towers on the 4ZW 400 kV overhead line (4ZW020A and 4ZW020B). Installation of two temporary masts/temporary towers during the construction phase would be required to facilitate the connection to the proposed Kiln Lane Substation. It could also include the re-conductoring of a short length of the 4ZW 400 kV overhead line and minor alterations to the towers approaching the proposed Kiln Lane Substation (4ZW015 to 4ZW024). OHL works would involve necessary outage plans and staged work approaches to be agreed with NGET.

2.3.28 Proposed works to the existing 4ZW 400 kV overhead line are shown in **Table 2.3.** Indicative tower types and heights are detailed in **Table 2.4**.

Table 2.3: Characteristics of 4ZW overhead line

Characteristic	Parameter
Tower type	Steel lattice – typical standard height, 90-degree bends
Tower height	Typically 54m
Tower footprint	Typically 340m^2
Span distance	Typically 350m
Land rights swathe	40-60m
Line Section length (section 4ZW19-4ZW27)	2.93km
New Line Section length (section 4ZW19-4ZW20A)	0.33km
New Line Section length (section 4ZW20B-4ZW27)	2.5km

Table 2.4: 4ZW overhead line indicative tower types and heights

Tower Name	Tower Condition	Tower Type	Indicative Height (m)
4ZW19	Existing to be maintained	L6 BB D60 E10	53.4
4ZW20A	New to be installed	L6 BB DT E10 (auxiliary cross-arms)	53.6
4ZW20B	New to be installed	L6 BB DT E10 (auxiliary cross-arms)	53.6
4ZW21	Existing to be maintained	L6 BB D E20	56.1
4ZW20A/B	Temporary Mast	MAST E3*	35.6

* Temporary towers that would be similar to the standard permanent towers, may be used instead of temporary masts.

Drainage

2.3.29 Drainage will follow Sustainable Drainage Systems (SuDS) principles and be designed not to increase flood risk. This will include the provision of appropriately sized attenuation.

Appearance

2.3.30 The appearance of the Kiln Lane Substation will be subject to detailed design.

Lighting

2.3.31 Lighting would meet the requirements of National Grid Technical Standard (TS) 2.10.04 Issue 1- 2017. This specifies that the minimum exterior lighting requirements are as follows.

a. Maintained average illuminance: 6.0 lux.
b. Maintained minimum point Illuminance: 2.5 lux.

2.3.32 The external lighting is not intended to facilitate maintenance activities for which it is assumed that additional portable equipment would be employed.

2.3.33 No lighting is proposed along the permanent access road.

Mitigation planting

2.3.34 Landscape and ecology mitigation design will be subject to further design evolution.

Limits of Deviation

2.3.35 The lateral LoD is illustrated in **Figure 2.2** of this PEIR. The extent of the lateral LoD allows for the necessary flexibility for the design process to continue to develop so that the most suitable position for the Full Build out of Kiln Lane Substation Scenario can be delivered.

Proposed Underground HVAC Cable Corridor

2.3.36 The proposed Underground HVAC Cables connect the proposed Kiln Lane Substation with the proposed Converter Station, which are located within Section A of the proposed Underground HVAC Cable Corridor.

Site and surroundings

2.3.37 Section A is shown on **Figure 2.1** of this PEIR and comprises the area between the proposed Kiln Lane Substation, situated north of the village of Friston and the proposed Converter Station, situated east of the village of Saxmundham.

2.3.38 The proposed Underground HVAC Cable Corridor would be routed in a general northwest direction from the proposed Kiln Lane Substation. At this time there are two potential proposed Underground HVAC Cable Corridor route options.

2.3.39 Both proposed Underground HVAC Cable Corridor options are largely within farmed agricultural fields, with interspersed woodland blocks and established hedgerows. Several residential properties are adjacent to the proposed corridors. There are PRoW that cross both proposed Underground HVAC Cable Corridor options. Only the Northern Route Option of the proposed Underground HVAC Cable Corridor is intersected by the B1119 Saxmundham Road.

Description

2.3.40 The proposed Underground HVAC Cables would have an operating voltage of 400kV.

2.3.41 The proposed Underground HVAC Cables would be laid in sections of up to 1km in length. These would be connected at joint bays with the cables earthed to allow access to the cable system during maintenance by above ground earthing link pillars or below ground earthing link boxes. The exact number of these will be confirmed as the design develops. The link pillars or link boxes would be located within a small fenced off area. Buried inspection boxes for the fibre optic cable would also be required, however, these would be flush to the ground or buried at the same depth as the cables.

Proposed Underground HVAC Cable Corridor delivery for Proposed Scheme infrastructure only

2.3.42 Where the Proposed Scheme is installing the proposed Underground HVAC Cables for this Proposed Scheme only, the cables would be installed in two trenches, each containing three HVAC power cables and up to two fibre optic cables. The exact formation can vary depending on the requirements of the route and ground conditions and would be determined as the design develops.

Characteristics

2.3.43 The characteristics and parameters that have informed the preliminary assessment are described in **Table 2.5.**

Table 2.5: Characteristics of proposed Underground HVAC Cables (Proposed Scheme infrastructure only)

Characteristic	Parameter
Construction footprint*	Up to 63m (typical) Up to 27m (narrow working width)**
Permanent easement*	Up to 21 m
No. of trenches	Two
No. of cables	Six power cables Up to two fibre optic cables Temperature monitoring fibres (six) attached to each power cable
Minimum depth of cover	Minimum depth to the top of protective tiles for: Roads and Footpaths – 0.75m Agricultural land – 0.9m Substation Boundaries – 0.6m
Total cable corridor length	2.2km
Cable joint bays	Up to six

*This does not include land that may be determined to be required for potential mitigation following further assessment.

Narrowed working width is described in **Section 2.5 Construction

Proposed Underground HVAC Cable Corridor delivery for Proposed Scheme in coordination with Sea Link

2.3.44 In this instance, proposed Underground HVAC Cables would be installed for the Proposed Scheme as well as ducting and cable joint bays for Sea Link at the locations they run concurrently with and/or cross LionLink cables. Three of the five trenches would be to lay ducting for the Sea Link HVAC and HVDC cables. As a result, the working width delivered by the Proposed Scheme to accommodate both projects would be greater than for the Proposed Scheme only and is defined in **Table 2.6.** The additional trenches for Sea Link would be constructed with empty ducts, leaving cable installation within these ducts subject to separate project consents obtained by NGET.

Characteristics

2.3.45 The characteristics and parameters that have informed the preliminary assessment are described in **Table 2.6.**

Table 2.6: Characteristics of the proposed Underground HVAC Cables (Proposed Scheme infrastructure and ducting for Sea Link)

Characteristic	Parameter
Construction footprint*	Up to 94m (typical) Up to 52m (narrowed working width)
Permanent easement*	Up to 21m**
No. of trenches	Five
No. of ducts	14 cable ducts and 5 fibre ducts
No. of cables (LionLink only)	Six power cables Up to two fibre optic cables Temperature monitoring fibres (six) attached to each power cable
Trench width/depth	Up to 2.45m x 1.5m (per trench)
Minimum depth of cover	Minimum depth to the top of protective tiles for: Roads and Footpaths - 0.75m Agricultural land - 0.9m Substation Boundaries - 0.6m
Total cable corridor length	2.1km
Cable joint bays	Up to 14 (up to 6 for the Proposed Scheme, plus up to 8 for Sea Link)
Maximum number of link pillar/boxes	Up to 6 (Proposed Scheme only)

*This does not include land that may be determined to be required for potential mitigation following further assessment.

**A permanent easement has not included for the ducts for Sea Link.

Above Ground Infrastructure

2.3.46 For both consenting scenarios, the Applicant would only install above ground infrastructure for the Proposed Scheme's proposed Underground HVAC Cables.

2.3.47 At each joint bay location and dependent on ground conditions: either an above ground link pillar or in ground link box is needed at each joint bay position.

2.3.48 Above ground link pillars would be, sized at up to 1.3m (H) x 0.5m (D) plus a suitably sized concrete foundation and possibly fencing depending on step and touch potential.

2.3.49 Link boxes would be located below ground with manhole covers for access, no requirement for foundation, typically a wooden fence enclosure around each link box, 4m x 4m x 1m (H) to prevent accidental damage.

2.3.50 Fibre optic inspection boxes; buried either flush to ground level or at depth of cable.

2.3.51 Cable marker posts will be installed. These markers inform and alert people to the presence of the live cables, and indicate safe and unsafe areas for activities such as digging.

Limits of Deviation

2.3.52 The lateral LoD is illustrated on **Figure 2.2** of this PEIR.

2.3.53 The proposed minimum burial depths are detailed in **Table 2.5** and **Table 2.6.** No lowest below ground vertical LoD has been specified, this is because to place a limit may unnecessarily restrict below ground works where there is little or no chance of likely significant effects resulting. For example, it may be necessary to undertake archaeological excavation, and to have placed a limit on the depth of such excavation works would be unnecessarily restrictive. A standard below ground LoD is not therefore proposed. Whilst a standard below ground LoD is not proposed, the Proposed Scheme would not go deeper than necessary for technical or environmental reasons as this would add engineering operational complexity and cost.

Proposed Converter Station

2.3.54 Converter stations are required to convert electricity from AC to DC (or vice versa depending on the direction of power flow). The proposed Converter Station would be connected into by both the proposed Underground HVAC Cables which route to the Kiln Lane Substation, and the proposed Underground HVDC Cables which route to the proposed Landfall Site and offshore.

Site and surroundings

2.3.55 The proposed Converter Station would be located on agricultural land to the east of the settlement of Saxmundham and south of the B1119 Saxmundham Road, illustrated on **Figure 2.2** of this PEIR. The site is bound to the north by the B1119 Saxmundham Road, and by agricultural fields to the east, south and west. A residential property is located adjacent to the site on the eastern side, and a small collection of residential properties are present adjacent to the northwest corner of the site behind a tree line. A small woodland is present adjacent to the southwest corner of the site, with a small pond approximately 100m beyond.

Description

2.3.56 The proposed Converter Station would comprise the following general components:

a. Up to seven main buildings:
   i. Two buildings, containing converter equipment, up to 26m in height;
   ii. One building containing converter neutral bay equipment, up to 26m in height;

   iii. One control building, containing control room, offices, welfare, meeting rooms, low-voltage alternating current, telecoms etc, up to 15m in height; and
   iv. Two spare parts storage buildings, up to 15m in height.
b. AC AIS switchgear yard, including AC AIS cable sealing ends within up to two buildings, up to 26m in height.
c. Converter Transformer compound, located between the Reactor Hall and the AC yard and Filter equipment.
d. Permanent access road and internal access road;
e. Site wide drainage;
f. Lighting; and
g. Landscaping / planting.

Characteristics

2.3.57 The characteristics and parameters that have informed the preliminary assessment are described in **Table 2.7**.

Table 2.7: Characteristics of the proposed Converter Station

Characteristics	Parameter
Permanent footprint*	Up to 8.1 ha
Finished ground level	19m to 21m AOD
Maximum no. of new buildings	Seven
Building height**	26m (up to 47m AOD)
External electrical equipment height	None

*this does not include land that may be required for potential mitigation following further assessment.

** excluding lightning protection, aerials, walkways, fall arrest equipment and potential architectural treatments (such as soft landscaping).

Permanent Access

2.3.58 The proposed Converter Station would require a new permanent access road. The proposed permanent access would be connect to the existing road network via a new bellmouth (LL-BM23) from the B1121 to the west of the proposed Converter Station, crossing the River Fromus via a new permanent bridge.

2.3.59 At the time of writing, the Sea Link project has sought consent for the same access in relation to their converter station. Should these works be completed as part of the Sea Link project in advance of the Proposed Scheme commencing development, no further work would be required for the Proposed Scheme as this would facilitate a permanent shared access.

2.3.60 In order to avoid the Proposed Scheme being reliant on third party works which are yet to be implemented, the Applicant is seeking consent for delivery of the permanent access.

2.3.61 Indicative dimensions for the Fromus Bridge crossing on which the preliminary assessment has been based are set out in **Table 2.8** subject to detailed design and further surveys.

Table 2.8 Indicative Dimensions for the River Fromus Bridge Crossing structure

Characteristic	Parameter
Clear span	24m
Width of bridge structure	6m
Assumed width of channel	8m
Height of sofit above top of bank	Up to 4m
Height of parapet	1m
Distance from top of parapet to ground level abutments	Up to 6m
Approximate slope of approach ramps	1 in 16 for Approach Ramps 1 in 3 for Earthworks Slope to the side of Approach Ramps
Approximate length of approach ramps	Up to 62m

Drainage

2.3.62 Drainage will follow Sustainable Drainage Systems (SuDS) principles and be designed not to increase flood risk. This will include the provision of appropriately sized attenuation measures to accommodate up to and including the 1 in 100-year return peak storm event with 45% climate change applied.

Appearance

2.3.63 The architectural design of the proposed Converter Station may vary within the physical parameters and LoDs set out above. The design of this structure, in terms of the building form and the external materials, will be developed alongside consultation and stakeholder feedback.

Lighting

2.3.64 Lighting at the proposed Converter Station will be motion activated, although there will be periods when lighting is required during nighttime hours to illuminate specific operations. The security lighting system will be directional, with indicative lighting heights of 5 – 7m along internal roadways and up to 12m in the yard.

2.3.65 No lighting is proposed along the permanent access road.

Mitigation planting

2.3.66 Landscape and ecology design will be subject to further design evolution.

Limits of Deviation

2.3.67 The lateral LoD is illustrated on **Figure 2.2** of this PEIR. The extent of the lateral LoD allows for the necessary flexibility for the design process to continue to develop so that the most suitable position for the proposed Converter Station can be delivered. The shape and arrangement of the converter compound may vary within the LoD however would not be greater than 8.1ha.

Proposed Underground HVDC Cables

2.3.68 The proposed Underground HVDC Cables would connect the proposed Converter Station, located to the east of Saxmundham, to the proposed Landfall Site at Walberswick.

Site and surroundings

2.3.69 The proposed Underground HVDC Cables are presented within Section B to Section D of the proposed Underground Cable Corridor, which are then broken down into sub sections and shown in **Figure 2.1** of this PEIR.

2.3.70 The proposed Underground HVDC Cable Corridor would exit the proposed Converter Station east of Saxmundham at the north side of the site. The proposed Underground HVDC Cable Corridor would largely be located through a rural setting, running northeast from the proposed Converter Station to then pass to the west of the village of Theberton, to the east of Middleton to reach an area just south of Blythburgh where it would turn east towards the village of Walberswick, to reach the proposed Landfall Site.

2.3.71 The proposed Underground HVDC Cable Corridor would be located to the east of the A12, which is not crossed directly by the route. The proposed SLR would be crossed just south of Middleton.

2.3.72 The corridor would be located largely to the west of several ecological designations located along the coast, namely Minsmere to Walberswick Heaths and Marshes Special Area of Conservation (SAC), Minsmere-Walberswick Heaths and Marshes Site of Special Scientific Interest (SSSI), Minsmere-Walberswick Ramsar Site and Minsmere-Walberswick Special Protection Area (SPA), however the corridor would cross beneath these designations at the proposed Landfall Site. The Suffolk & Essex Coast & Heaths National Landscape is east of the proposed Underground HVDC Cable Corridor, until the turning point around Blythburgh where the corridor would enter the designation all the way to the proposed Landfall Site south of Walberswick.

Description

2.3.73 The proposed Underground HVDC Cable Corridor route has been selected so that as much as possible of it can be installed in open and flat land, without natural obstacles like slopes or open water (see **Chapter 3 Alternatives and Design Evolution** of this PEIR for further description of route selection process).

2.3.74 There are two proposed construction methods for the installation of the proposed Underground HVDC Cable Corridor; open cut excavation which would involve removal of soils, laying cable ducts and backfilling, and trenchless installations which have been proposed where practicable for the crossing of railways, existing roads, sensitive habitats such as hedgerows, woodland and water courses, as well environmental designations. Construction techniques are further described in **Section 2.5**.

2.3.75 The proposed Underground HVDC Cables would have an operating voltage of 525kV. The final diameter of the cables will be confirmed as the design develops.

2.3.76 The proposed Underground HVDC Cables would be installed in one trench, containing two power cables, one dedicated metallic return cable, and up to two fibre optic cables. The formation can vary depending on the requirements of the route and ground conditions, which would be determined as the design develops.

2.3.77 The proposed Underground HVDC cables would be laid in sections up to 1.5km in length. These would be connected at joint bays with the only remaining above ground aspect being cable marker posts. The exact number of these joint bays will be confirmed as the design develops.

Characteristics

2.3.78 The characteristics and parameters that have informed the preliminary assessment are described in **Table 2.9**.

Table 2.9: Characteristics of the proposed Underground HVDC Cable Corridor

Characteristic	Parameter
Construction footprint*	Up to 46 m (typical) Up to 19.5m (narrowed working width)
Permanent easement*	15m
No. of trenches	One
No. of cables	Two power cables One dedicated metallic return (DMR) cable, Two fibre optic communication cables Three fibre optic monitoring cables placed alongside the power cables and DMR cable.
Trench width/depth	Up to 2.45m x 1.5m (per trench)
Minimum depth of cover	Minimum depth to the top of protective tiles for: Roads and Footpaths – 0.75m Agricultural land – 1.2m Substation Boundaries – 0.6m Watercourses – 2m Railways – 5m

Characteristic	Parameter
Total cable corridor length	Approximately 20km
Cable joint bays	Up to 22 joint bays

*This does not include land that may be determined to be required for potential mitigation following the assessment.

Above ground infrastructure

2.3.79 Cable marker posts will be installed along the proposed Underground HVDC Cable Corridor. These markers inform and alert people to the presence of the live cables.

Limits of Deviation

2.3.80 The lateral LoD is illustrated on **Figure 2.2** of this PEIR.

2.3.81 The extent of the lateral LoD allows for the necessary flexibility for the design process to continue to develop so that the most suitable cable route can be delivered.

2.3.82 The standard burial depths are detailed in **Table 2.9**. No lowest below ground vertical LoD has been specified, this is because to place a limit may unnecessarily restrict below ground works where there is little or no chance of likely significant effects resulting. For example, it may be necessary to undertake archaeological excavation, and to have placed a limit on the depth of such exaction works would be unnecessarily restrictive. A below ground LoD is not therefore proposed. Whilst a below ground LoD is not proposed, the Proposed Scheme would never go deeper than necessary for technical or environmental reasons as this would add engineering operational complexity and cost.

Proposed Landfall

2.3.83 The Landfall would form the transition between the proposed Underground HVDC Cable Corridor and the proposed Offshore HVDC Cable Corridor.

Site and surroundings

2.3.84 The proposed Landfall Site is the proposed interface between the Proposed Onshore Scheme and Proposed Offshore Scheme, and would be situated on an agricultural field adjacent to the southern edge of Walberswick village, which is a historic Conservation Area. The Landfall Site would have residential properties adjacent to the north, east and west, and the Minsmere to Walberswick Heaths and Marshes SAC, Minsmere-Walberswick Heaths and Marshes SSSI, Minsmere-Walberswick Ramsar Site and Minsmere-Walberswick SPA to the south. The Dunwich River, which runs adjacent to the beach, would be located to the southeast of the proposed Landfall Site. The proposed Landfall Site would be within the Suffolk & Essex Coast & Heaths National Landscape and the Heritage Coast. Several Public Rights of Way (PRoW) run along the edge of the proposed

Landfall Site and link up with the tourist village of Walberswick and its associated harbour.

Description

2.3.85 The proposed Underground HVDC Cables would be protected within ducts connected via a transition joint bay (TJB) to the proposed Offshore HVDC Cables. The proposed Underground HVDC Cables and proposed Offshore HVDC Cables in this location would be installed using Horizontal Directional Drilling (HDD).

2.3.86 The proposed Underground HVDC Cables and proposed Offshore HVDC Cables would be jointed together at the TJB which is proposed to be located as close to the coast as possible whilst taking account of environmental and technical constraints. It is anticipated that one TJB is required for the Proposed Scheme, containing all three jointed cables.

2.3.87 Design and final position of the TJB and trenchless installation alignment will take into consideration predicted coastal erosion, flood zones and beach draw down rates to ensure that it is positioned sufficiently far back from the coast and that the ducts are sufficiently deep so that the infrastructure would not become exposed with changes to coastline.

The permanent infrastructure above ground would be cable marker posts along the route at field boundaries, crossings and other locations as appropriate.

Characteristics

2.3.88 The characteristics and parameters that have informed the preliminary assessment are described in **Table 2.10**.

Table 2.10: Characteristics of the proposed Landfall

Key Characteristic	Description
Permanent cable easement*	15m
Number of ducts	Up to four
HDD Length	Up to 1.6km
HDD depth	Up to 31m
Minimum depth of cover top of cable	1.2m

*this does not include land that may be determined to be required for potential mitigation following the assessment

Access

2.3.89 No permanent access road to the proposed Landfall is required.

Limits of Deviation

2.3.90 The lateral LoD is illustrated on **Figure 2.2** of this PEIR. The extent of the lateral LoD allows for the necessary flexibility for the design process to continue to develop so that the most suitable position for proposed Landfall can be delivered.

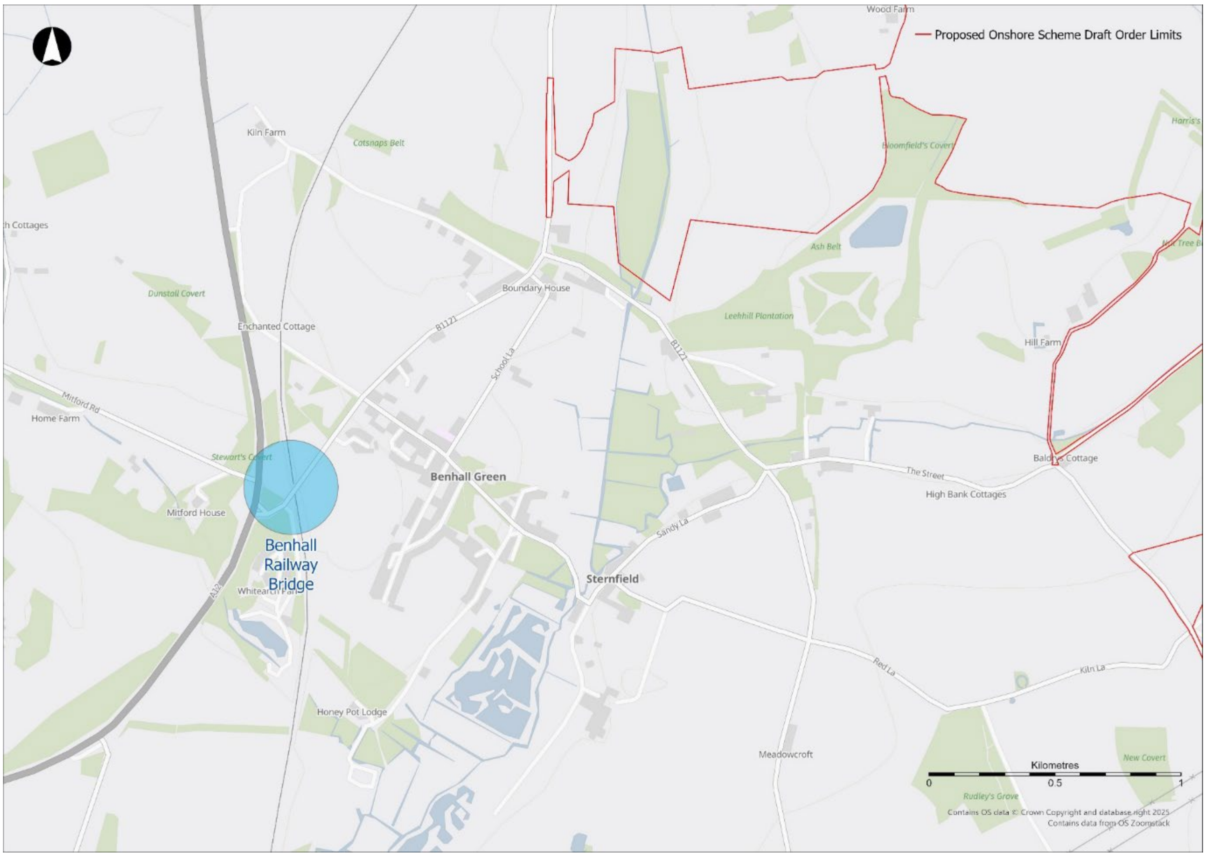
2.3.91 No lowest below ground vertical LoD has been specified. Whilst a standard below ground LoD is not proposed, the Proposed Scheme would not go deeper than necessary for technical or environmental reasons as this would add engineering operational complexity and cost.

Off-site Highways Works

2.3.92 Local and strategic traffic modelling is yet to be undertaken for the Proposed Onshore Scheme. This modelling would identify highway interventions that may be needed on the highway network to facilitate the construction of the Proposed Onshore Scheme (referred to as the 'Off-Site Highway Works') and to mitigate potential adverse effects on the highway network.

2.3.93 As part of ongoing discussions with the Local Highway Authority on transport routing impacts associated with construction (including abnormal indivisible load (AIL) movements), the Applicant is considering the potential for works that may be required at Benhall Railway Bridge on the B1121 (see **Inset 2.2**).

Inset 2.2: Benhall Railway Bridge on the B1121



2.3.94 The Applicant acknowledges the Change Request for the Sea Link Project that was submitted to the Planning Inspectorate in September 2025 to amend their Order limits to add in Benhall Railway bridge and adjacent land to the east and along the railway line to respond to requests from Suffolk County Council (SCC) and East Suffolk Council (ESC).

2.3.95 The Applicant plans to include this bridge within the Order Limits for the Proposed Scheme to consent associated works required to facilitate the proposed use of the bridge and Off-Site Highway Works junctions for construction traffic, particularly AIL movements as may be required following further assessment and engagement with SCC, ESC and the Sea Link project.

2.3.96 Further discussions to coordinate this work are ongoing, and relevant information and assessment will be provided within the Environmental Statement and the application for development consent.

2.4 Proposed Offshore Scheme

2.4.1 The Proposed Offshore Scheme would route from the proposed Landfall Site across the Southern North Sea to the boundary between the UK and Netherlands EEZ, a distance of approximately 182km.

2.4.2 Within Dutch waters the proposed Offshore HVDC Cables would connect to a Dutch Offshore Wind Farm (OWF) chosen by TenneT, the Dutch transmission system owner and operator. This connection to a Dutch OWF would fall out with the scope of the Proposed Scheme.

Proposed Offshore Scheme Description

2.4.3 The Proposed Offshore Scheme comprises the following components:

a. Two proposed Offshore HVDC Cables;
b. One proposed dedicated metallic return (DMR) cable;
c. One proposed fibre optic cable; and
d. Associated external cable protection (e.g., rock berm, concrete mattresses, rock bags etc) necessary where the required burial into the seabed cannot be achieved or where the Proposed Offshore Scheme crosses existing infrastructure such as In Service cables or pipelines.

Proposed Landfall

2.4.4 The proposed Landfall is the interface between the Proposed Onshore and Proposed Offshore Scheme. The location of the landfall is at Walberswick in Suffolk on the east coast of England and is shown in **Figure 2.4**.

2.4.5 The proposed Landfall would be constructed using a trenchless technique such as HDD (as described in **Paragraph 2.5.138** to **2.5.156**). Three cable ducts would be installed from the TJB, positioned above the mean high-water spring (MHWS) mark, to a point below 0m lowest astronomical tide (LAT). The exact exit points for the cable ducts would depend on further technical studies and design. The

HDD will likely 'punch out' (exit the seabed) between the 5m and 9m LAT water depth contours which is between 450m and 900m offshore from Mean High Water Springs (MWHS) within the area indicated in **Figure 2.8** of this PEIR.

Proposed Offshore HVDC Cable Corridor

2.4.6 At the EIA Scoping stage, two proposed Offshore HVDC Cable Corridors were presented, Route B and Route C. The options appraisal process informed by technical and environmental assessments and stakeholder consultation, concluded that the preferred route was Route B, which has been taken forward with a few minor adjustments as the proposed Offshore HVDC Cable Corridor. Further information about alternative routes can be found in **Chapter 3 Alternatives and Design Evolutions** of this PEIR.

2.4.7 The proposed Offshore HVDC Cable Corridor is nominally 500m wide and is of a sufficient width to contain all the construction works within it.

2.4.8 The extent of the marine characterisation survey undertaken in 2024 has informed the extent of the DOL for the Proposed Offshore Scheme. The Proposed Offshore Scheme locations have been broken down into Kilometre Points (KP). With KP 0 starting at the proposed Landfall Site in Walberswick continuing up the EEZ.

2.4.9 The proposed Offshore HVDC Cables would be installed within the proposed Offshore HVDC Cable Corridor. The data acquired during the marine characterisation survey and any further surveys would be used to refine the initial route and develop a micro-routed centreline that as far as possible avoided features that would require seabed clearance activities or would cause an installation challenge. The Proposed Offshore Scheme would be installed in one seabed trench.

2.4.10 The proposed Offshore HVDC Cable Corridor also includes an option for avoiding Aggregate Area 2109 (Indefatigable East) that was announced in late 2024 near KP154 to KP167. While the Project is in discussions with the Aggregate Area owner regarding the original route, an alternative route is included within the assessments. The alternative cable corridor avoids the boundary of Aggregate Area 2109 by 500m while remaining as close to the original alignment as possible. The 500m exclusion zone is a generally accepted industry standard used for most constraints when undertaking marine spatial planning. A single route will be provided for the ES.

2.4.11 **Figure 2.4** of this PEIR illustrates the Proposed Offshore Scheme and **Figures 2.5a** to **2.5f** of this PEIR illustrate the DOL for the Proposed Offshore Scheme subdivided into 30km sections.

Proposed Offshore HVDC Cables

2.4.12 The Proposed Offshore Scheme would be a bi-pole HVDC configuration (one cable with positive polarity (Pole 1) and one cable with negative polarity (Pole 2)) with a DMR and fibre optic.

2.4.13 The introduction of a DMR allows Pole 1 and Pole 2 to operate independently of each other. This means that if either of the Poles fail, the remaining Pole can continue with the DMR, and the transmission capacity is not lost. If for any reason the DMR is damaged, the two Poles can be switched to operate in a rigid bi-pole configuration, again allowing transmission capacity to continue. This configuration increases the overall resilience of the link.

2.4.14 It is expected that all cables will be installed in one trench.

2.4.15 Each cable would be installed in multiple sections, with each section connected by a joint.

Proposed Offshore HVDC Cables Design

2.4.16 The proposed Offshore HVDC Cables would have a nominal voltage of 525kV. Typically, each HVDC cable would have an outer diameter of 150mm to 190mm.

2.4.17 The cables contain no free liquid or gases that could be released into the marine environment even in the event of severe mechanical damage to the cables.

Proposed Dedicated Metallic Return Cable Design

2.4.18 The proposed DMR would be slightly smaller than the proposed Offshore HVDC Cables with an outer diameter of 120mm to 140mm. It would have a nominal voltage of 60kV and would also be non-draining and contain no free liquid or gases.

Proposed Fibre Optic Cable Design

2.4.19 A single proposed fibre optic cable would be used. The proposed fibre optic cable would provide a communication link between the converter station in Suffolk and the offshore Dutch converter station. The outer diameter of the proposed fibre optic cable is expected to be between 20mm to 30mm.

2.4.20 The proposed fibre optic cable would not include any repeaters and would not have an electrical current running through it.

Cable protection

2.4.21 The nature of the seabed varies along the submarine cable route so the choice of burial technique or protection method will vary along the route depending upon the seabed conditions present in each section or where the cable crosses a third-party asset.

2.4.22 Where possible the cables will be buried in the seabed as this provides the best protection for the cable and minimises potential for interference with fishing activity. Where the seabed composition is not suitable for burial or where unexpected obstacles in the seabed are encountered during cable installation, external cable protection will be provided through either rock placement, concrete (or frond) mattresses, rock bags or protective coverings.

2.4.23 Cable protection away from asset crossings typically uses rock placement. Rock placement protects subsea cables by covering them in a continuous profiled berm of graded rock. The berm provides a strong protective cover to prevent potential impact and snagging from fishing vessels, and also ensures stability by shielding the cable from the current flow.

2.4.24 Asset crossing agreements will be made with third parties owning live or disused cables and pipelines which the Project will cross. These agreements detail the physical design of the crossing, which will vary depending upon the specific cable protection requirements of the owner or operator of the third-party subsea asset that will be crossed.

Summary of proposed Offshore HVDC Cable Corridor and Cable Parameters

2.4.25 Key aspects of the proposed Offshore HVDC Cable Corridor and proposed Offshore HVDC Cables aspects and parameters are summarised below in **Table 2.11**.

Table 2.11: Summary of proposed Offshore HVDC Cable Corridor and parameters

Aspect	Parameter	Value	Comments
Proposed Offshore HVDC Cable Corridor	Width	500m	
	Total Length in UK Waters	Up to 182km	Approx 32km in territorial waters Approx 150km in UK EEZ
Proposed Offshore HVDC Cables	Configuration	2 / Bi-pole	One cable per pole
	Joints	2	
	Operating voltage	525kV	Nominal
	Transmission capacity	Up to 2.0GW	
	Outer diameter	150-190mm	Per cable
Proposed Fibre Optic Cable	Number	1	
	Joints	2	
	Outer diameter	20-30mm	
Proposed Dedicated Metallic Return Cable	Number	1	
	Joints	2	
	Operating voltage	Up to 66kV	
	Outer diameter	120-140mm	
Proposed Offshore HVDC Cable Corridor	Number	1	
	Maximum depth of trench	2. 5m	Defined in **Appendix 2.7 Outline Cable Burial Risk Assessment** of this PEIR.
	Maximum trench width	5m	Dependant on the installation technique used and sediment type, but would usually be between 2-3m.
	Disturbed area (from trenching)	Up to 15m	Based on typical width of trenching machinery.

2.5 Indicative Construction Activities

2.5.1 At this PEIR stage, the precise approach to construction is still being developed and refined through the EIA process.

2.5.2 This section has been provided to give context to stakeholders of the expected nature and scale of activities associated with the Proposed Scheme. The characteristics that have informed this preliminary assessment are set out in **Section 2.3 and Section 2.4.**

Onshore

2.5.3 This section outlines the anticipated approach to the construction of the Proposed Onshore Scheme. Where relevant, the technical chapters within **Chapters 6 to 29** have incorporated control and management measures when proposing their assessment scope.

Outline Onshore Code of Construction Practice

2.5.4 The **Outline Onshore Code of Construction Practice** (CoCP) provided as **Appendix 2.1** of this PEIR describes control measures and standards proposed to be implemented throughout the construction of the Proposed Onshore Scheme. The Outline Onshore CoCP will be updated for submission as part of the application for development consent, with the intention that provision of a detailed Onshore CoCP (to be based on the outline) will be required post-consent in advance of construction activities commencing – this would be secured through the DCO.

2.5.5 Whilst multiple construction works at different geographical locations would run concurrently throughout the Proposed Scheme, the Onshore CoCP would act as the overarching document for all onshore construction related activity. The Onshore CoCP would present a consistent approach to the environmental management of construction activities for the duration of construction of the Proposed Onshore Scheme.

Onshore construction programme

2.5.6 Following the decision to approve development consent for the Proposed Scheme, enabling works would be expected to begin in 2028, with completion of construction expected in 2032. The anticipated duration of the construction is therefore up to five years.

2.5.7 Indicative duration periods for the enabling, construction and reinstatement of each of the components of the Proposed Onshore Scheme are as follows:

a. Kiln Lane Substation:
   i. Amendments to Kiln Lane Substation Scenario: approximately 18 months
   ii. Proposed Full Build Out of Kiln Lane Substation Scenario: approximately three years
b. Proposed Underground HVAC Cable Corridor: approximately three years

c. Proposed Converter Station: approximately five years
d. Proposed Underground HVDC Cable Corridor: approximately two years and three months.
e. Proposed Landfall: approximately 18 months.

2.5.8 Exact timing would be influenced by the installation approach of the Proposed Offshore Scheme.

Construction workforce

2.5.9 The workforce required to deliver the construction of the Proposed Scheme will vary throughout the construction programme.

2.5.10 It is forecasted that the average daily number of site personnel for the peak month across the whole of the Proposed Onshore Scheme would reach approximately 669 (Full Build Out of Kiln Lane Substation Scenario), or approximately 501 (Amendment to Kiln Lane Substation).

Construction working hours

2.5.11 The construction working hours, unless otherwise approved by the Local Planning Authority, are proposed as:

a. Monday – Friday 07:00hrs–19:00hrs;
b. Saturday, Sundays and Bank Holidays: 07:00hrs–17:00hrs

2.5.12 The construction working hours exclude start up and close down activities up to 1 hour either side of the construction working hours. These activities include staff arrival, briefings, checking plant, loading equipment, compound general maintenance activities, debriefing, storing equipment and plant, and staff leaving site.

2.5.13 The Applicant is continuing to work to reduce working hours where possible, through engagement with third parties and the Local Planning Authorities, and where possible, works would be scheduled to minimise impacts to the local community.

2.5.14 This may include but not limited to:

a. No percussive pilling would be undertaken on Sundays or Bank Holidays.
b. No HGV deliveries to be undertaken on Sundays or Bank Holidays (other than those necessary to undertake the operations listed in the exclusions in **Paragraph 2.5.15**).
c. Special considerations around landfall working and school holidays.

2.5.15 Exceptions to the above include but are not limited to:

a. Continuous periods of operation such as: concrete pouring (TJB, joint bays and proposed Converter Station), dewatering, cable pulling, cable jointing, drilling during the operation of a trenchless technique (e.g. HDD), and installation and removal of conductors, pilot wires and associated protective netting across highways or public footpaths for OHL works;

b. Internal fitting-out works within buildings associated with the Kiln Lane Substation and proposed Converter Station;
c. Delivery to the worksite of abnormal loads that may cause congestion on the local road network (e.g. transformer delivery vehicles for the proposed Converter Station, Cable Drum delivery) or any other highway works requested by the highway authority to be undertaken on a Saturday, Sunday or Bank Holiday outside of core working hours;
d. Testing or commissioning;
e. Completion of construction activities commenced during the approved working hours which cannot safely be stopped;
f. Activities necessary in the instance of an emergency where there is a risk to persons, delivery of electricity or property; and
g. Intrusive or non-intrusive survey works (habitat or environmental etc).

Pre-construction

2.5.16 Prior to any works on site, detailed site investigations and up to date surveys would be undertaken to inform the delivery of the construction works, where necessary, in consultation with key stakeholders. This may include ecological surveys, amongst other investigations.

Site enabling works

2.5.17 Enabling works will be required prior to the commencement of the construction of the Proposed Scheme. These are likely to be similar across the components of the Proposed Onshore Scheme.

2.5.18 These temporary enabling works may include:

a. Erection of temporary or permanent fences around works and compound areas with suitable gated access.
b. Vegetation clearance and soil removal.
c. Installation of bellmouths where new accesses or widening of existing accesses from the public highway are required.
d. Construction of internal haul roads.
e. Stoppage and or diversions of PRoWs.
f. Installation of temporary water control measures.
g. Installation of temporary construction compounds and facilities.
h. Earthworks, including land re-profiling to establish a level platform for construction of the proposed Converter Station and temporary platform for the proposed Landfall construction activities.
i. Delivery of plant / site vehicles and materials – sequence and quantity will be defined by the construction programme and associated bill of quantities.

Site fencing

2.5.19 Temporary and permanent site fencing would be required for the Proposed Onshore Scheme:

a. Temporary fencing: temporary perimeter fencing system offering construction boundary demarcation. Security measures would be applied as appropriate.

Once the construction phase is complete, temporary fencing would be removed.

b. Permanent fencing: perimeter fencing would be placed along the complete boundary of the proposed Converter Station Site and the Kiln Lane Substation Site; this will also act as boundary demarcation throughout the Proposed Scheme's lifecycle.
c. Should above ground link pillars be required along the proposed Underground HVAC Cable Corridor, these would be fenced to protect the equipment from step or touch, as agreed with individual landowners depending on the potential for step and touch.

Vegetation clearance and soil removal

2.5.20 Vegetation clearance in advance of construction works would be undertaken under the supervision of an Ecological Clerk of Works (ECoW), and only in areas identified as necessary for the construction of the Proposed Onshore Scheme. Meeting requirements as detailed in **Appendix 2.1 Outline Onshore CoCP** of this PEIR.

2.5.21 Topsoils, and sub soils would be removed and retained for reinstatement at the end of construction.

Bellmouths

2.5.22 Bellmouths would be required for temporary construction access to the Proposed Onshore Scheme, and permanent access to the Kiln Lane Substation and proposed Converter Station. The proposed locations of bellmouths are shown on **Figure 2.2**.

2.5.23 Temporary bellmouths are still under discussion with local planning authorities, therefore, for the purposes of this PEIR, all presently known construction accesses have been presented and assessed.

2.5.24 Sizing of the bellmouths would be in accordance with the relevant design guidance and the vehicles required to access/egress the site. Visibility requirements would dictate where the bellmouths can be positioned. Normally, traffic management measures and/or a reduced speed limits are required to safely manage the interaction between works traffic and the public highway at bellmouths, particularly where visibility may be limited.

2.5.25 As part of design evolution, the number of temporary bellmouths are likely to be reduced. It may also be identified that upgrades or alterations to elements of the public highway are needed to deliver bellmouths for site access. These will be defined and presented within the ES.

Haul roads

2.5.26 Construction haul roads would be required to facilitate access and construction of the proposed Underground Cable Corridor, Kiln Lane Substation, proposed Converter Station, and proposed Landfall, and to provide a stable platform on which to store or manoeuvre materials. There are a number of different options available including temporary track way, stone roads and soil stabilisation.

2.5.27 Haul roads would be constructed to a suitable width, in most instances approximately 7 m wide, to allow for passing vehicles, although this may extend in limited areas to provide turning for HGVs and construction plant.

2.5.28 Appropriate drainage systems would be installed to haul roads to enable sound use throughout construction in accordance with requirements detailed in **Appendix 2.1 Outline Onshore CoCP**, of this PEIR.

Public Rights of Way

2.5.29 The Proposed Onshore Scheme would cross the existing PRoW network. The works which would be required at these locations can be classified into four categories. These are:

a. Provisions – at these locations a diversion would not be required. However, safety measures would be put in place to maintain access during the construction period. The installation of safety measures is likely to require short term closures or the control of users using stop go boards or similar, to allow for the installation of fences, gates or overhead netting as required.
b. Long term temporary diversion – at these locations a diversion route would be provided for the duration of the construction works.
c. Short term temporary diversion – at these locations, the impact on the PRoW is caused by isolated construction activities, so a diversion would only be required for a reduced period of time. These diversions would be implemented within the Draft Order Limits locally to the PRoW affected. For example, during the installation of haul roads or ducts across the PRoW, the route would be temporarily diverted 50-100 m along the alignment of the Draft Order Limits to cross a section already installed or an area not yet reached by the works.
d. Permanent diversion – the design of the Proposed Onshore Scheme has avoided permanent diversions as much as possible. However, at certain locations the route of the existing PRoW would be impacted by the permanent components, and a permanent diversion route would therefore be required.

2.5.30 PRoWs within the Draft Order Limits will be physically separated from construction routes and activities by appropriate fencing and signposting, as required. Where PRoW intersect active construction haul roads, appropriate management would be implemented to ensure safe crossing points.

2.5.31 Further details of the treatment of individual PRoW will be provided and assessed within the ES.

Water control

2.5.32 SuDS would be used where appropriate. Engagement with land owners will inform these works.

2.5.33 Temporary culverts would be required where the construction haul roads cross existing watercourses, i.e. ditches, field drains, dykes and small rivers. Culverts would be in place for the duration of the works and removed upon completion. Generally, these are limited to circa 3m wide and extend to approximately 2m beyond the width of the road. The type of culvert is dependent upon the size and the ecological and hydrological properties of the ditch. Typical types include concrete pipes, plastic (twinwall) pipes and pre-cast concrete modular units (box or portal culverts). Each have slightly varied and specific methods of installation.

2.5.34 The number and locations of culverts will be specified as design progresses and detailed in the ES.

2.5.35 Drainage works would be undertaken on the site, including diversions of existing watercourses, installation of new stormwater and foul water drainage, and construction of any interceptor tanks and/or attenuation/infiltration ponds.

2.5.36 All drainage for the Kiln Lane Substation, proposed Converter Station and temporary construction compounds across the Proposed Onshore Scheme would be installed at the initial stage of the construction phase to avoid any waterlogging during construction. Where groundwater is elevated, lining of the ponds with an impermeable liner may be necessary to mitigate groundwater ingress, and anchoring of the liner may be required to manage buoyancy.

Construction compounds

2.5.37 Temporary Construction Compounds (TCCs) are areas which will be utilised for the storage of plant and machinery and stockpiling materials, as well as the provision of site management offices, welfare facilities for staff (kitchen facilities, storerooms, toilet facilities), parking for construction vehicles, staff cars, and delivery trucks.

2.5.38 TCCs would be established across the Proposed Onshore Scheme within the Draft Order Limits. At this stage of design development, optionality remains in the site selection for TCCs to deliver the Proposed Onshore Scheme. The proposed locations of these TCCs are set out on **Figure 2.2**. Continued design refinement will allow for the rationalisation of the number of TCCs prior to the application for development consent for the Proposed Scheme.

2.5.39 The following types of TCCs are proposed:

a. Primary TCCs – these would be larger in size and would be in place for the duration of cable construction.
b. Secondary TCCs – these would likely be in place for the majority of construction, but not the full duration. These would likely be along the cable corridor such as at trenchless crossings and at the proposed Landfall site.
c. Trenchless crossing compounds – these smaller compounds would be in place at the trenchless crossing locations to manage the launch and reception of the trenchless crossing techniques.

2.5.40 The proposed footprint of the TCC would vary depending on the compound's use and section of the route served. **Table 2.12** provides a description of the maximum construction compound parameters.

Table 2.12: Indicative temporary construction compound parameters

Location	Type	Indicative area	Number required	Likely duration
Kiln Lane Substation	Primary	170m by 170m	Up to three	Up to three years
Proposed Underground HVAC Cable Corridor	Primary	180m by 80m	Up to three	Up to 17 months
	Secondary	75m by 50m	Up to three	Up to 12 months
	Trenchless crossings	30m by 30m	Northern route - four Southern route - none	Up to 12 months
Proposed Converter Station	Primary	200m by 200m	One	Up to five years
Proposed Underground HVDC Cable Corridor	Primary	200m by 80m	Up to three	Up to 19 months
	Secondary	70m by 70m	Up to five	Up to 12 months
	Trenchless crossings	30m by 30m	36 (indicative)	Between four to 12 months
Proposed Landfall	Secondary	110m by 75m	One	Up to 18 months

Earthworks

2.5.41 Earthworks would begin upon completion of site establishment, involving levelling of the site and creation of the platform to the necessary levels according to the topography and to facilitate drainage. Landscaping involving earth bunds may also be completed at this stage to reduce the visual impact of the completed compound.

Deliveries

2.5.42 Deliveries of plant and materials will be required throughout the construction programme of the Proposed Onshore Scheme. Subject to the exceptions listed in **Paragraph 2.5.15**, Heavy Goods Vehicles (HGV) deliveries would be limited to Monday – Friday: 0700 to 1900 and 0700 to 1700 on Saturdays and may not occur on Bank Holidays, unless otherwise approved by the relevant authorities.

Construction activities associated with the Proposed Onshore Scheme Components

Kiln Lane Substation

2.5.43 Construction access to the Kiln Lane Substation in the Amendments to Kiln Lane Substation Scenario would utilise a construction bellmouth on the B1121 using the haul road associated with the proposed Converter Station and proposed Underground HVAC Cable Corridor. Construction access to the Kiln Lane Substation in the Full Buildout of Kiln Lane Substation Scenario would utilise a construction route from the south entering site at bellmouth on the B1069 Snape Road.

2.5.44 Temporary lighting would be required at the site for construction during shorter days, and only used during working hours. No 24 hour lighting is expected to be required.

2.5.45 A typical sequence for the construction of works for the Amendments to Kiln Lane Substation Scenario, would involve:

a. Pre-construction site investigations and surveys;
b. Enabling works and site establishment as described in **Paragraph 2.5.18** to **2.5.42**;
c. Civil and building works including construction of building foundations, outdoor electrical equipment foundations, permanent drainage systems and internal roads and parking, construction of all building units, erection of steel frames and cladding;
d. Mechanical and electrical works for the GIS extensions and bay installations, and of Series Reactor unit and associated Gas Insulated Busbar (GIB) connections;
e. Modifications to existing permanent services – water, foul drainage, low voltage electricity supplies and telecommunications, (if required);
f. Outage works to connect to the existing substation;

g. Commissioning - following completion of all construction works there would be a period of commissioning and testing;
h. Energisation; and
i. Site reinstatement and landscape works, including removal of site offices and temporary facilities, land reinstatement and landscape works.

2.5.46 Should the construction of the Full Build Out of Kiln Lane Substation Scenario be required, the construction sequence above would require OHL reconfiguration works under outages including temporary towers/masts, to be undertaken prior to Kil Lane Substation building works, following the same sequence thereafter.

OHL construction works (Full Build Out of Kiln Lane Substation Scenario only)

2.5.47 The construction of the section of 400 kV overhead line would generally be sequenced as follows:

a. Pre-construction investigations and enabling works described in **Paragraph 2.5.18** to **2.5.42**.
b. Foundations for permanent and temporary structures: topsoil stripping, temporary drainage installation where required, excavation and disposal of excavated soil for pad and chimney foundations, installation of tower foundations (pad and column, mini pile, tube pile or bespoke).
c. Erection of overhead line structures including temporary structures: layout of steelwork in preparation for erection, assembly (painting if required) and erection of steelwork, installation of insulator strings including fittings, installation of protection prior to stringing of conductors, including scaffolding.
d. Overhead line structure (tower) dismantling: detachment of conductors, removal of fittings and/or hardware and insulators, tower dismantling in sections and lower to the ground, removal of foundations.
e. Stringing of conductors: establishment of machine sites for conductor stringing; including equipotential zones, conductor stringing, conductor sagging and clamping including damper installation, installation of spacers.
f. Re-instatement.

Proposed Converter Station

2.5.48 Construction access to the proposed Converter Station is proposed from the west via a bellmouth on the B1121 and would require a crossing of the River Fromus (as described in **Paragraph 2.3.58**).

2.5.49 To construct the proposed Converter Station, a level surface would need to be created. Given the topography of the proposed Converter Station Site, it is likely that a balanced cut and fill will be utilised to create a single level platform, therefore retaining all material on site for landscaping and site reprofiling, minimising the need for import and export. Volumetric analysis has identified a level platform between approximately 19 m and 21.07 m AOD would be required to meet this balance.

2.5.50 Temporary lighting would be required at the site for construction during shorter days. No 24 hour lighting is expected to be required.

2.5.51 Typical construction methodologies for a converter station of this scale may include but not limited to:

a. Pre-construction investigations and enabling works described in **Paragraph 2.5.18** to **2.5.42**;
b. Foundation construction including foundations for buildings, transformers, and other heavy equipment. Shallow foundations would be suitable depending on the applied structural loads. Alternatively, piled foundations would be used for structures with high loadings.
c. Erection of steel frames for the main buildings, such as valve halls and control rooms. Structural steel components would be lifted and assembled using mobile cranes of up to 50 m high, ensuring alignment and stability. Installation of roofing systems and external cladding to protect the buildings from environmental conditions while providing thermal insulation.
d. Construction of underground cable trenches, duct banks, and utility tunnels for HV cables, control wiring, and cooling systems. Trenches may be prefabricated or cast in situ depending on available space and the number of cables for routing. Ducts would be installed individually (a single tube) or as multi-ducts (multiple tubes in one) depending on the thermal requirements of the cables within the ducts, system redundancy, or available space. Utility tunnels are rare and typically consist of buried precast concrete tubes/box sections with internal bracketry to support cables off the base of the tunnel.
e. Installation of civil infrastructure including internal roads, drainage systems for surface water, foul water and oily water, and fencing.
f. Installation of any permanent services such as site lighting mounted on columns/buildings, CCTV mounted on columns/buildings or fibre-optic intruder detection systems installed along the fence.
g. Mechanical and electrical works.
h. Internal fit-out of the buildings (first and second fix) and MEP works.
i. Commissioning.
j. Site reinstatement and proposed landscaping.

Proposed Underground HVAC Cables and proposed Underground HVDC Cables

2.5.52 Whilst the number of cables and working width vary depending on whether the proposed Underground Cable is HVAC or HVDC, the sequence and method of construction and installation is the same and has therefore been described together below.

Construction Access

2.5.53 The Proposed Onshore Scheme is expected to require access by Abnormal and Indivisible Loads (AIL) transporting various HV infrastructure, for example, cable drums and ducts. Mobile cranes may be required to offload the equipment from these vehicles.

2.5.54 Potential accesses from public roads are shown in **Figure 2.2**, and optionality remains as to which proposed bellmouths will be used for the construction of the proposed Underground HVAC Cables and proposed Underground HVDC Cables.

2.5.55 As engagement continues with local authorities and interested parties to refine design, optionality remains. Final construction accesses will be presented within the ES.

2.5.56 Access points would be positioned to allow suitable visibility splays for safe access and egress, and avoid the need for excessive manoeuvring within the public highway. In some locations temporary traffic management measures could be used to control access.

2.5.57 To reduce local road use, temporary haul roads of approximately 7.5m width would be used for construction traffic within the proposed Underground Cable Corridor, avoiding sensitive areas. Temporary drainage, likely provided as a ditch parallel to the haul route, may be needed to manage runoff. Allowance has been made within the DOL for temporary haul roads, TCCs and temporary working areas.

2.5.58 Vehicle access along the working width may require the installation of temporary bridges across some minor tributaries, ditches and drains (not applicable for Main Rivers). Following consultation with the relevant bodies, single span bridges may be used in places which have limitations on the maximum span of bridges allowed to take construction and AIL traffic. It has therefore been assumed that watercourses that are navigable or that cannot be crossed with a single span bridge would not be crossed by temporary bridges (e.g., installation works would be undertaken from either side of the watercourse). As a result, additional temporary accesses are required either side of larger watercourse crossings.

2.5.59 The exact method of cable delivery would be outlined as the design develops and will be developed to accommodate the likely delivery methods based on similar projects. It is assumed that cable delivery vehicles would only use approved delivery routes and/or the temporary haul road within the working width. An outline Construction Traffic Management Plan (CTMP) will be prepared which identifies the proposed routeing of construction traffic and submitted as part of the DCO application. As with the Onshore CoCP, provision and approval of a final CTMP will be secured through the DCO as a post-consent requirement.

Cable installation

2.5.60 The area required to install the cable is defined as the required working width. Depending on the constraints in the area two approaches may adopted:

a. Typical working width: This contains the typical elements required for the enabling works and construction of a cable trench, including the temporary fence position, soil bunding for topsoil strip and subsoil, drainage ditches, haul road and cable trench. Other elements associated with construction such as laydown, vehicle parking and equipment storage may feature within the working width but are considered to be transient and so are excluded.
b. Narrow working width: A narrowed working width may be utilised to minimise the impact on environmentally sensitive sites, for example a significant hedgerow where environmental constraints need to be avoided. Narrowing the corridor is accomplished by relocating the topsoil and sub soil stockpiles

and requires larger construction corridors on either side of the sensitive site to accommodate the additional storage of soil.

2.5.61 The method of construction would not vary within the HVAC Cable Route Proposed Scheme infrastructure with ducting for Sea Link scenario, however, there would be an increase in the number of trenches and working widths within this scenario to account for both projects. See **Section 2.3 Proposed Onshore Scheme** for a description of the number of trenches for the proposed Underground HVAC Cables and proposed Underground HVDC Cables.

2.5.62 The formation can vary depending on the requirements of the route and ground conditions, and would be determined as the design develops.

2.5.63 The proposed Underground HVAC Cables would be laid in sections up to 1km in length and the proposed Underground HVDC Cables would be laid in sections up to 1.5km. These would be connected at joint bays which for the proposed Underground HVAC Cables would be below ground earthing link boxes or above ground earthing link pillars, see **Table 2.5** for more details. No below ground earthing link boxes or above ground earthing link pillars are required for the proposed Underground HVDC Cables.

2.5.64 There are multiple cable installation techniques available. The cable installation techniques under consideration for the Proposed Onshore Scheme are:

a. Open cut trench and ducting. This is the preferred method of cable installation due to enhanced physical protection of cables and ease of cable pulling. This technique involves excavation, placement of cable ducts, and reinstatement over the cable ducts. Cables would then be brought on cable drums and pulled into the ducts at joint bays. Temporary haul roads would remain on the route after the installation of ducts so that cable drums can access joint bays so cables can be pulled into place;
b. Open cut trench and direct burial (no ducting). There may be areas where a direct buried solution of cables may be more economical which will be explored as the design develops; and,
c. Trenchless method: Typically horizontal directional drilling (HDD), although pipe jacking (horizontal auger boring) and micro boring may be required. Trenchless methods would be used in locations where open cut trench methods are not viable such as at railway crossings.

2.5.65 Cable installation would require temporary construction facilities and access. These temporary construction facilities would consist of haul roads, laybys and/or passing places to allow movement of construction traffic. As required, there may be the need for temporary dewatering and drainage.

2.5.66 Temporary road closures may also be required. These are anticipated to be on Moor Road, Darsham Road (Westleton), Lymballs Lane, Hinton Road and Lodge Road to allow for open cut excavation. A localised bypass would be provided at Moor Road, Lymballs Lane and Lodge Road to maintain access for vehicles and non-motorised users. Darsham Road (Westleton) and Hinton Road would be closed but with access for non-motorised users maintained. Temporary road closures are anticipated to be less than five consecutive days and managed in coordination with other project activities in the area at the time, details of which would be provided in the CTMP available alongside the ES.

2.5.67 Cable installation may occur at multiple sections of the route in parallel as it does not need to happen sequentially. This could limit the duration of cable construction activities; however, it would depend on several factors including the underlying ground conditions and installation methods used.

2.5.68 The precise method of installation is subject to detailed design following the appointment of a contractor.

Cable joint bays

2.5.69 Cable joint bays will be provided along the proposed Underground Cable Corridor to facilitate the jointing of cables, these will all be below ground.

2.5.70 Cable joint bays are typically positioned to minimise conflict with other underground or above ground services, and to facilitate the ease of installation and maintenance. Precast cable joint bays may be adopted for this Proposed Onshore Scheme and provide a clean environment for the assembly of cable joints as well as bonding and earthing leads. The Proposed Onshore Scheme would use a combination of both precast and in-situ cable joint bays depending on the site conditions. Following the completion of jointing and duct sealing works in the joint bay, a suitable material would be placed and thoroughly compacted to the level of the cable and cable joint base to provide vertical support. Protective tiles and tape are installed, and the remaining excavation is backfilled to restore original site conditions.

2.5.71 Link box pits (below ground) or link box pillars (above ground) are also installed at joint bays, allowing for access during maintenance. Every joint for the proposed Underground HVAC Cables would feature a link box/pillar. Fibre pits may also be installed at joint bays along both the HVDC and HVAC cable routes, which allow for inspection and testing of the fibre optic cable systems.

Proposed Landfall

2.5.72 Construction access would be via the haul road associated with the proposed Underground HVDC Cable Corridor, via a bellmouth from the B1387.

2.5.73 Enabling earthworks would be required as part of the construction activities at the proposed Landfall Site to achieve a safe and level working area for drilling operations and joint bay installation; which would include cut and/or fill to engineer the present slope. The landfall construction platform is proposed to be lower than existing ground level, at approximately 6.5m AOD, to minimise views to the proposed Landfall Site. A cut fill balance is proposed for the creation of the proposed landfall temporary platform to maintain materials on site, minimising import and or export.

2.5.74 Activities at the proposed Landfall Site which will require 24-hour working include drilling, reaming, duct pulling and cable pulling. The proposed Landfall Site would require up to four HDDs. Each HDD is expected to take up to 6 weeks to complete subject to site conditions. It is not anticipated that 24-hour working will be required to be continuous for the entire period of these construction activities. In most cases, continuous 24-hour construction activities at the proposed Landfall Site are expected to be limited to a maximum of 10 consecutive days per HDD. However, longer periods may be necessary in exceptional circumstances, such as unforeseen delays or emergencies. The construction approach will be developed further, assessed as part of the EIA and reported in more detail in the ES.

2.5.75 Temporary lighting would be required at the site for construction during shorter days (such as during the winter months) and during activities which require nighttime or continuous working.

2.5.76 Typical construction methodologies for a landfall may include but are not limited to:

a. Enabling works, including the creation site access and of a temporary platform;
b. Installation of temporary drainage for the platform, including a possible attenuation basin. An additional basin may be required for drilling fluid returns.
c. Construction/installation of a launch pit for the HDD;
d. Construction/installation of reinforced concrete thrust blocks for the HDD rig; and
e. Construction of the duct strings and associated supporting infrastructure consisting of rollers positioned at discrete intervals.

Transition Joint Bay (TJB)

2.5.77 A TJB connects the offshore cables to the onshore cables and is usually positioned to align with the HDD trajectory so as to minimise the pulling tensions on the subsea cables. A TJB is typically located on the HDD platform.

2.5.78 The TJB for the Proposed Scheme would be buried underground and provide the following functions:

a. a controlled environment for cable installation / pull-back;
b. an anchor point for the proposed Offshore HVDC Cables;
c. suitable alignment and compatibility with the HDD operations; and
d. allow for the earthing configuration of the cable system via link boxes.

2.5.79 It is anticipated that there would be a concrete slab at the base of the joint bay. There would be open trenching at either side of the joint bay to allow for lifting the cables to the correct height inside the jointing container and to allow for snaking.

2.5.80 Typical construction methodologies for a TJB may include but are not limited to:

a. Excavation of the joint bay installation area, including temporary man access ramps/steps;
b. Compaction of the ground (typically only required if soft spots are identified). Alternatively, further excavation and backfill of soft spots may be implemented;
c. Construction of the concrete joint bay slab (preparation of the ground, installation of formwork, installation of steel reinforcement cage, pouring concrete, concrete finishing). Alternatively, and if deemed appropriate, precast concrete slabs may be laid on prepared ground.
d. Backfilling of the excavation once the cables are installed and tested.

Reinstatement post-construction

2.5.81 Following the completion of construction activities, unless agreed in advance with landowners and / or the LPA, reinstatement measures would include:

a. The removal of all construction machinery, TCCs and associated compound facilities;
b. the removal of temporary access/haul routes and restoration of alterations to accesses; and
c. the reinstatement of soils, implementation of landscaping and planting, as appropriate.

2.5.82 Permanent easements along the proposed Underground HVAC Cable Corridor and proposed Underground HVDC Cable Corridor would allow the resumption of normal farming activities, however, limitations to planting to shallow rooted agricultural crops, hedgerows or bushes may apply. This is to prevent roots from affecting and potentially damaging the cables. For example, roots of trees may grow around the cable ducts, therefore, tree movement from external factors like wind could add indirect pressure on the apparatus, and in the instance of an uprooting, displace and damage apparatus.

2.5.83 Where trenchless installation techniques are proposed along the proposed Underground Cable Corridor, trees may be able to be planted, however, restricted to 5m in depth.

Proposed Offshore Scheme

Indicative Programme

2.5.84 The construction programme for the Proposed Offshore Scheme is expected to commence in 2028 with completion due in 2032.

2.5.85 The exact timing of the construction works would be dependent upon the date of the contract award, time required for detailed design and cable manufacture, availability of cable, cable lay vessel and construction vessels and any restrictions to mitigate effects on features of environmental interest, fisheries or other sensitive receptors.

2.5.86 The length of time of an activity would depend on the final scope of works, cable installation method, vessels and equipment, and weather and operational downtime.

2.5.87 It is anticipated that construction will be split into multiple campaigns; a route preparation campaign and installation campaigns. The main activities that would comprise the route preparation are listed below:

a. Pre-construction Unexploded Ordnance (UXO) survey (Identification);
b. UXO clearance (any UXO clearance would require its own marine license which would be applied for separately if necessary);
c. Route preparation (pre-lay grapnel run (PLGR), boulder clearance, pre-sweeping, infrastructure crossing preparation, out of service (OOS) cable removal);
d. HDD site set up; and
e. HDD cable installation.

2.5.88 For the purposes of assessment, it has been assumed that multiple installation campaigns of the Proposed Offshore Scheme would be required. The main activities per installation campaign are listed below:

a. Pre-lay offshore survey;
b. Cable trenching;
c. Cable lay;
d. Infrastructure crossings;
e. Jointing;
f. Remedial external cable protection; and
g. Post lay survey.

2.5.89 The sequence of activities shown above is indicative only. Alternatively, the seabed preparation works could be split and precede each of the cable lay and burial campaigns.

2.5.90 At this stage in the design, and to inform **Chapter 21 Intertidal and Offshore Ornithology**, the total maximum of working days for the activities in **Paragraph 2.5.88** within the Outer Thames Estuary SPA is limited to 213 days. Further detail on assumptions is set out in the chapter and its associated appendices.

Pre-installation activities

2.5.91 Prior to the installation of the proposed Offshore HVDC Cables, certain activities would be undertaken to prepare the route for cable lay.

Pre-installation survey

2.5.92 Although detailed marine surveys have been undertaken for the Proposed Offshore Scheme, further surveys would be carried out prior to the start of cable installation. The objectives of these surveys would be:

a. To confirm that no new obstructions have appeared on the seabed since the 2024 marine surveys were undertaken;

b. To establish the final position for infrastructure crossings;
c. To establish a reference seabed level against which the depth of burial of cables can be compared;
d. To determine the position of any potential UXO;
e. To support the micro-routeing of the cables around any mobile bedforms, archaeological features or sensitive habitats; and
f. To provide a pre-installation baseline should it be required for post-construction monitoring purposes.

2.5.93 The pre-installation surveys will likely be conducted using an ROV that involve a range of marine survey techniques including:

a. Multi-Beam Echo Sounder (MBES): used to record water depth, prepare a three dimensional (3D) digital terrain model of the seabed, and to identify relevant bedforms and bathymetry.
b. Side Scan Sonar (SSS): maps the seabed surface and is used for identification of sediment types, obstacles lying on the seabed, such as wrecks, debris, , and surface-laid or exposed pipelines and cables that might affect cable installation.
c. Sub-Bottom Profiling (SBP): directs a pulse of acoustic energy into the seabed. Using reflections from the sub-surface geology it can assess the thickness, stratification, and nature of the seabed sediments.
d. Magnetometer: passive detection of magnetic anomalies compared to the earth's magnetic field. Such anomalies can be caused by geological faults and buried metallic objects such as UXO, pipelines, cables and archaeological features.

2.5.94 The pre-installation survey would typically be split into two elements: nearshore (<10m of water) and offshore (>10m of water). These surveys would be carried out by an Remotely Operated Vehicle (ROV) onboard the support vessels.

2.5.95 An offshore vessel is generally larger and can conduct 24-hour operations. The towed sensors, sensor arrays and equipment are stored on the back deck potentially in dedicated garages and are deployed using a crane or vessel A-frame or through a moon pool in the ship's hull.

2.5.96 A nearshore vessel is generally smaller and due to its reduction in size can be used in shallower water depths. Operations are usually kept to 12 hours (or daylight hours) with the sensors and equipment stored in pallet cases/boxes on the back deck; however if the size of vessel allows, night working or 24-hour operations would still be possible.

2.5.97 The data acquired by both vessels would be to the same or very similar standard.

Unexploded Ordnance (UXO) Identification

2.5.98 A desk-based study and risk assessment for potential UXO contamination across the Proposed Offshore Scheme has been undertaken and has which informed the position and development of the Proposed Offshore Scheme. This included a wide area UXO assessment to inform cable routeing which highlighted areas of likely higher UXO mitigation requirements, and therefore informed from a UXO standpoint, areas which should be avoided within the routeing. Once the Proposed Offshore Scheme was defined a more detailed UXO risk assessment of the specific, former military and UXO related activities that have taken place in the vicinity of the Proposed Offshore Scheme was undertaken.

2.5.99 Publicly available data from archives (databases, military and national), historic maps, aerial photographs and records, internet research and research documents were used to characterise the types of ordnance likely to be present within the Proposed Offshore Scheme's Draft Order Limits. The assessment has found there to be a moderate risk of encountering UXO. **Table 2.13** lists the types of ordnance which have been used in the vicinity of the Proposed Offshore Scheme and therefore could be present, along with the likelihood of their presence and the maximum quantity of explosive associated with the UXO.

Table 2.13: UXO type and presence within the Proposed Offshore Scheme's Draft Order Limits

UXO	Likelihood of presence	Net Explosive Quantity (NEQ)
Small arms ammunition	Low	<50kg
Land service ammunition	Low	101kg
High explosive bombs	Moderate	260kg
Sea mines	Moderate	697kg
Torpedoes	Low- Moderate	365kg
Depth charges	Moderate	272kg
Missiles/rockets	Low	<50kg

2.5.100 The offshore geophysical survey completed in 2024 was designed to detect any significant seabed features and obstacles within the proposed Offshore HVDC Cable Corridor to allow micro-routeing around such constraints.

2.5.101 A more detailed UXO specific pre-construction survey using a magnetometer array would be undertaken prior to seabed clearance and cable lay, to characterise and investigate any anomalies that may be UXO in more detail. Magnetometers are passive devices which detect magnetic anomalies that may not be detected by standard geophysical survey equipment.

2.5.102 The extent of the UXO survey would be nominally 25m to 40m either side of the proposed cable centreline (50m to 80m total); the route along which the cable will be laid and buried within the proposed Offshore HVDC Cable Corridor. It is undertaken using a geophysical survey vessel(s).

2.5.103 The data acquired during the survey would be used to map potential UXO (pUXO) and undertake further micro-routeing of the cable centreline to avoid as many pUXO as possible.

2.5.104 Any pUXO detected during the survey that cannot be avoided by route engineering, would be further investigated to confirm whether it is UXO, an archaeological feature or debris.

2.5.105 Any pUXO identified as a target for investigation would be surveyed in one of two ways:

a. Diver survey using a circular search pattern with handheld magnetometer to identify the position of the target and using a low pressure water jet and dredge system; and/or
b. Remote Operated Vehicle (ROV) equipped with magnetometer, dredge pump and sonar.

2.5.106 A minimum 5m x 5m grid would be investigated around each target. Should scrap/debris be identified during the survey e.g., objects with ferrous content, this would be removed to surface to be disposed of according to the Waste Hierarchy and Waste Regulations 2011 (Ref 3). Targets covered by sediment would be exposed. A small pit would generally be excavated, until the target is sufficiently exposed to confirm whether it is UXO. Where debris has been identified and removed, investigations would continue until the entire search grid is complete, in case debris had masked the presence of UXOs.

2.5.107 Any non-explosive debris that cannot be removed to surface (e.g., for health and safety reasons), would be relocated on the seabed within the Draft Order Limits.

2.5.108 A Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) (**Appendix 26.4** of this PEIR) would be followed throughout the UXO identification campaign, and a marine archaeologist would be on hand in case any targets have archaeological potential.

UXO Clearance

2.5.109 A separate marine license for UXO clearance will be applied for post DCO approval if required.

Route Preparation

2.5.110 Prior to the installation of the Proposed Offshore Scheme the seabed needs to be prepared for the burial equipment. Activities that would be undertaken may include:

a. Boulder clearance;
b. PLGR;
c. Sandwave clearance;
d. Preparation of infrastructure crossings;
e. OOS cable clearance.

Boulder Clearance

2.5.111 Geophysical data would be used to inform the requirement for boulder clearance within the proposed Offshore HVDC Cable Corridor. It may be possible to micro-route around boulders, however if there are large volumes present in the area, they would need to be cleared away from the cable route centreline so that burial equipment can operate.

2.5.112 There are several methods that can be used for boulder clearance. Where possible a grab would be used to individually target and move boulders. Boulders would be moved away from the cable centreline and positioned within the Draft Order Limits. However, where there are high volumes of boulders, a SCAR plough or similar would be employed. The SCAR plough pushes boulders to either side of the centreline clearing a swathe of between 10m and 20m. A second pass, or wider plough would be required if a larger seabed swathe is needed.

2.5.113 Boulder clearance would be undertaken from a construction support vessel. For the purposes of determining a design envelope for boulder clearance, it is assumed that up to 17% of the Proposed Offshore Scheme length would require boulder clearance, however the boulders present are isolated and likely to be cleared using a grab. The total area of seabed which may be disturbed by boulder clearance using a SCAR plough technique is 0.6km^2, however this is expected to be greatly reduced once the results of the pre-construction surveys are known. Other parts of the Proposed Offshore Scheme may need isolated boulder cleared using a grab tool. It is unknown maximum number of isolated boulders needing clearing at this stage however boulder clearance parameters are shown in is presented in **Table 2.14**.

Table 2.14: Boulder Clearance Parameters

Parameter	Fully bundled solution (one trench)
Length of cable route requiring boulder clearance using SCAR plough type tool (%)	Up to 17%
Length of cable route requiring boulder clearance using SCAR plough type tool (km)	Up to 30km
Width of boulder plough / clearance tool	20m
Total area of seabed disturbed by boulder plough / clearance tool (km^2)	0.6km^2
Additional isolated boulders which may need clearance with grab type tool	Unknown at this stage
Depth of seabed disturbed by clearance plough	Approx. 30cm

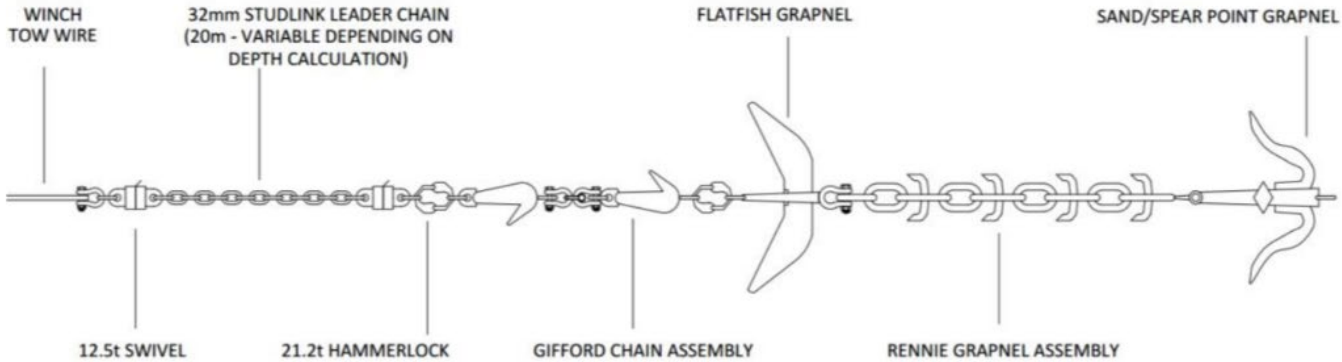
Pre-lay grapnel run (PLGR)

2.5.114 The objective of a PLGR is to clear any debris from the seabed which could be detrimental to the cable installation process. The PLGR vessel (typically a construction support vessel) tows a wire which has a chain of specially designed hooks, or grapnels on it. It is towed along the centreline until it encounters debris. An illustration of a typical PLGR grapnel is provided in **Inset 2.3.**

2.5.115 The grapnel is designed to capture debris on the surface and just below the surface of the seabed. Debris (such as scrap trawler warps, old cable, ghost fishing gear) caught with the grapnel would be recovered to the vessel for appropriate licensed disposal onshore.

2.5.116 As described above, cable lay and burial would be undertaken during several campaigns. The PLGR operation would be either undertaken for the entire route in one campaign or phased to ensure that the route is clear of debris before each campaign; typically undertaken a couple of days before cable lay and burial.

Inset 2.3: Typical Grapnel



Source: EGL 2 (Ref 4)

Table 2.15: PLGR Parameters

Parameter	Fully bundled solution (one trench)
Length of cable route requiring PLGR (%)	100%
Length of cable route requiring PLGR (km)	182km
Width of PLGR clearance corridor (m)	30m
Total area of seabed disturbed by PLGR (km^2)	5.46km^2

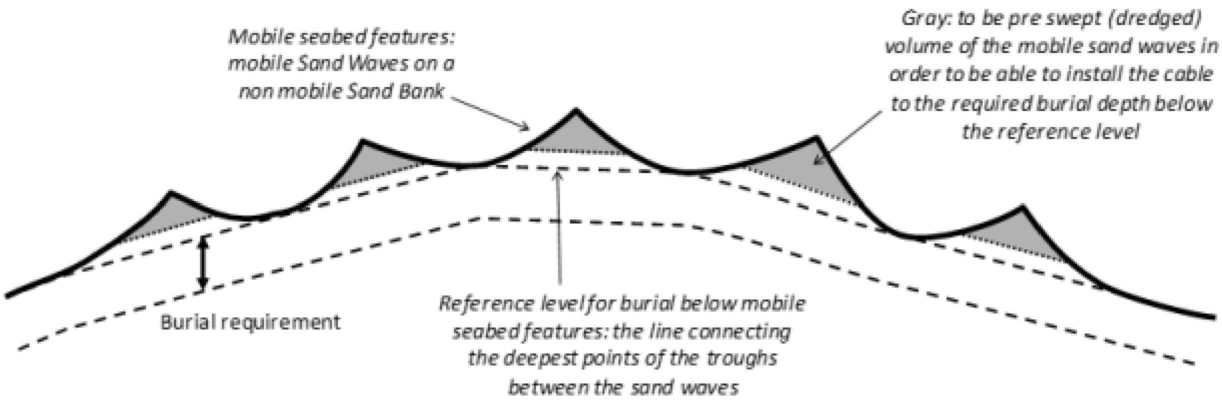
Sand wave clearance and disposal of dredged material

2.5.117 In areas where mega ripples (wave heights <1.5m) and sand waves (wave heights >1.5m) have formed along the proposed Offshore HVDC Cable Corridor, pre-sweeping may be undertaken prior to cable burial to:

a. Allow the burial equipment to safely move along the cable centreline (avoiding steep slopes); and
b. Allow the burial equipment to reach the required burial depth (preventing future cable exposures).

2.5.118 Sand waves can present a major technical challenge for both towed and self-propelled burial equipment. Burial equipment commonly work on long inclines of up to 10-15°. For commonly available machines, the practical limit for burial depth is 3m. By removing a proportion of the sand wave prior to installation, the burial machine can reach further down and place the cables below the level at which they may be affected by the mobility of the bedform feature (the non-mobile reference level) and can reduce the slope angle ensuring the burial machine does not topple or tilt over, as illustrated in **Inset 2.4.**

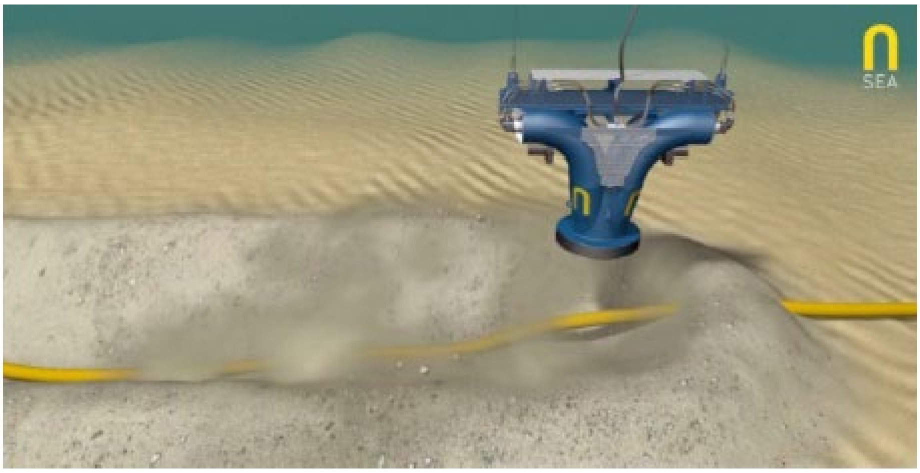
Inset 2.4: Illustration of sand wave clearance



2.5.119 Pre-sweeping can be undertaken using two different techniques:

a. Controlled flow excavator (CFE) - A technique that uses highly pressurised water directed at the seabed to push sediment to either side of a trench. Also commonly referred to as a mass flow excavator (MFE). An example is shown in **Inset 2.5.** This equipment works best where the sand waves are <3m, it creates a wide footprint and uneven ground where the sand is pushed aside.
b. Trailing suction hopper dredger (TSHD) - A dredging vessel that uses a suction pipe (the trailing drag head) to suck up sediment off the seabed. The sediment is discharged into a compartment (the hopper) on the vessel. An example is shown in **Inset 2.6**. The sand can either be retained in the hopper or deposited back on the seabed by opening the hopper doors, alternatively it can be side cast as the dredging occurs to allow the sand to settle away from the trench. Compared to the CFE the TSHD can create a defined trench with a stable flat bottom, typically seabed disturbance is narrower using this technique.

Inset 2.5: Example of a CFE



Inset 2.6: TSHD with suction pipe deployed

2.5.120 The area to be pre-swept would be wide enough for the passage of the burial equipment at the base of the sand wave; typically between 10 – 20m. Where pre-sweeping is required, it would be undertaken several days to a few weeks in advance of cable lay and burial to ensure the path remains open for cable installation to take place.

2.5.121 If seabed material is dredged, it would be re-distributed within the Draft Order Limits in agreed disposal locations. The preference would be for the dredged spoil to be returned to the seabed in the vicinity of the dredged area where practical. The proposed disposal sites for the Proposed Offshore Scheme are presented in **Figure 2.6** of this PEIR. Material from the TSHD would be released at the water surface within the disposal sites.

2.5.122 The requirements for sand wave clearance will vary along the proposed Offshore HVDC Cable Corridor. The determination of depths and locations will be made post consent and would be informed by the cable burial risk assessment (CBRA) and pre-installation surveys, which can be compared to the marine characterisation survey data to determine seabed mobility. However, the maximum areas and volumes would not exceed those presented in **Table 2.16.**

Table 2.16: Sand wave clearance parameters

Parameter	Fully bundled solution (one trench)
Length of cable route requiring sandwave clearance (%)	8.18%
Length of cable route requiring sandwave clearance (km)	14.2km
Maximum clearance width (m)	20m
Total area of seabed disturbed by sandwave clearance (km^2)	0.29km^2
Maximum volume of sediment disturbed by sandwave clearance (m^3)	170,000m^3
Maximum volume of sediment cleared from sandwaves requiring disposal (m^3)	170,000m^3

Preparation of infrastructure crossings

2.5.123 The Proposed Offshore Scheme crosses over several types of third-party infrastructure which have been identified through desk top studies and the marine characterisation survey. The crossing of infrastructure is made with the prior agreement of the owners following a negotiated formal Crossing Agreement. This would lay out the design of the crossing, describing aspects such as crossing angle, the vertical separation to be achieved between the Proposed Offshore Scheme and the third-party asset.

2.5.124 Where the third-party infrastructure is no longer in service, agreements would be made to cut and remove a section of the asset to allow the Proposed Offshore Scheme to continue cable burial unimpeded.

2.5.125 The infrastructure that crosses the Proposed Offshore Scheme is illustrated in **Figure 2.7** of this PEIR and includes:

a. 13 x in service (IS) cables and pipelines (two cables are crossed twice);
b. 2 x proposed offshore wind farm export cables;
c. 4 x abandoned pipelines; and
d. 15 x out of service (OOS) telecommunication cables (two cables are crossed twice).

In service telecommunications cables

2.5.126 The Proposed Offshore Scheme would cross over the IS cables on a ‘bridge’ comprised of either aggregate (rock) or concrete mattresses. This protective layer provides vertical separation between the Proposed Offshore Scheme and the IS cable, ensuring they would not touch. Separation could also be provided by installing a protective material around the Proposed Offshore Scheme (such as tekduct or Uraduct). The separation layer would be the first layer of protective material that would be positioned during route preparation by a pre-construction vessel using either a crane or a fall pipe. Construction of the remainder of the crossing is described in **Paragraphs 2.5.201** to **2.5.206**. This would cover the protective layer and would have a larger seabed footprint than the initial deposits.

2.5.127 A list of the IS telecommunications cable identified from spatially mapped data sources (e.g. KIS-ORCA and Admiralty charts) as crossing the Proposed Offshore Scheme's Draft Order Limits is provided in **Table 2.17**. The 2024 geophysical survey sought to locate this infrastructure. Infrastructure that was not identified during this survey is in italics. However, for the purposes of assessment it is assumed that infrastructure crossings would be required for all eight crossings.

Table 2.17: In service telecommunications cables

Asset Name	KP	Water Depth (m)	Depth of burial (m)
Ulysses 2	*31.2*	*43.3*	*Unknown*
Circe North	*50.3*	*47.6*	*Unknown*
Pangea segment 2	*51.4*	*46.2*	*Unknown*
Circe North 2	52.3	45.3	Unknown
Scylla & Scylla RD	*53.6*	*43.4*	*Unknown*
Iceni	*85.7*	*43.5*	*Unknown*
Sea-Me_WE3	188.2	29.0	1.83

Proposed export cables from offshore wind farms

2.5.128 It is understood that the Norfolk Vanguard East and Norfolk Boreas Wind Farm export cables would be installed after the Proposed Offshore Scheme. However, if this is not the case, the crossing construction would follow the same methodology as for the IS telecommunications cables. **Table 2.18** presents the anticipated position of the crossings. For the purposes of assessment, it has been assumed that these crossings would be required.

Table 2.18: Proposed export cables from offshore wind farms

Asset Name	KP	Water Depth (m)	Depth of burial (m)
Norfolk Boreas Export Cable (x2 cables)	90.3	38.8	Unknown
Norfolk Vanguard East Export Cable	90.9	38.3	Unknown

In service (IS) pipelines

2.5.129 The Proposed Offshore Scheme would cross over buried IS pipelines similarly to IS cables on a 'bridge' comprised of either aggregate (rock) or concrete mattresses.

2.5.130 Where an IS pipeline is surface laid, subject to third party negotiations, a concrete pipeline crossing bridge or similar would be constructed to allow the cable to be laid over the top of the pipeline. The seabed may be stabilised by aggregate (rock) around the pipeline before the bridge is installed. The alternative method would be to use aggregate rock around the surface laid pipeline before the pipeline is crossed.

2.5.131 A list of the IS pipelines identified from spatially mapped data sources (e.g., North Sea Transition Authority and Admiralty charts) as crossing the Proposed Offshore Scheme's Draft Order Limits is provided in **Table 2.19**. All pipelines were identified in the 2024 geophysical survey.

Table 2.19: In-service pipelines crossings

Asset Name	KP	Water Depth (m)	Depth of burial (m)
Bacton to Zeebrugge Pipeline	43.7	42.8	0.15
BBL Balzand to Bacton Pipeline	96.8	38.4	0.00
Davy to Inde-AT Pipeline	141	27.9	1.62
Zeepipe 1	182.7	30.7	0.00
Franpipe	182.8	30.6	0.00

Abandoned/out of service (OOS) pipelines

2.5.132 Four OOS/abandoned pipelines, as listed in **Table 2.20** have been identified as crossing the Proposed Offshore Scheme's Draft Order Limits. All pipelines are currently buried and were recorded as decommissioned in 2017 with pipelines remaining in-situ. As they have been decommissioned, a crossing structure would be needed for the pipelines. As all pipelines are confirmed to be buried, the construction methodology would be similar to that proposed for surface laid pipelines.

Table 2.20: Abandoned pipelines

Asset Name	KP	Water Depth (m)	Depth of burial (m)
Horne and Wren Export Pipeline	108.8	37.3	0.83
Thames to Welland Pipeline	121.0	33.9	1.31
Thames to Orwell Pipeline Meg	134.2	34.3	1.48
Thames to Orwell control umbilical	134.2	34.6	1.48

OOS telecommunication cables

2.5.133 A list of the 13 OOS telecommunications cable identified from spatially mapped data sources (e.g., KIS-ORCA and Admiralty charts) as crossing the Proposed

Offshore Scheme's Draft Order Limits is provided in **Table 2.21**. The 2024 geophysical survey sought to locate this infrastructure. Infrastructure that was not identified during this survey is in italics.

2.5.134 Agreement would be sought from the cable owners to cut the OOS cables. The pre-construction surveys would have identified the position of the OOS cable. At the known location of the cable a grapnel would be used to try and retrieve the cable. Should this be unsuccessful, then a de-trenching grapnel would be deployed, which is able to penetrate the seabed up to 2m, to retrieve the cable.

2.5.135 Once the OOS cable is retrieved to the vessel, the cable would be cut, and the ends secured with clump weights and returned to the seabed in accordance with guidelines from the International Cable Protection Committee (ICPC) recommendation No 1 (Ref 5).

2.5.136 The length of cable to be removed would be agreed with the asset owner in advance, but typically a section 100m to 250m either side of the centre line, would be removed. This could be extended if identified it would be beneficial for fishers. For the purposes of assessment, it has been assumed that a maximum of 500m of OOS cable would be removed.

2.5.137 The clearance of OOS cables would be undertaken by a construction support vessel during the seabed clearance campaign.

Table 2.21: OOS cables

Asset Name	KP	Water Depth (m)	Depth of burial (m)
UK-NL 7 Telecom	*8.1*	*22.1*	*Unknown*
UK-NL 6 Telecom	*9.1*	*21.8*	*Unknown*
UK-NL 4 Telecom	29.4	37.9	1.22
UK-NL 5 Telecom	*33.8*	*47.5*	*Unknown*
Rembrandt 1	*47.1*	*48.6*	*Unknown*
UK-NL 10 Telecom	*59.7*	*49.9*	*Unknown*
UK-Germany 5	87.2	43.6	1.42
UK-NL 14	94.5	36.6	0.86
UK-Germany 3 Telecom	*100.3*	*38.2*	*Unknown*
Winterton – Borkum 1 Telecom	*116.3*	*35.6*	*Unknown*
UK-DK3 Telecom	118.1	35.5	0.15
UK-Germany 4 Telecom	*149.3*	*32.0*	*Unknown*
UK-DK 1 Telecom	163.9	28.6	0.71

Proposed Offshore Scheme Landfall Enabling Works and Cable Pull- In

Offshore HDD

2.5.138 The method for drilling cable ducts from the HDD compound to the offshore exit point is described in **Paragraph 2.5.139**. Up to three High Density Polyethylene (HDPE) ducts would be installed, exiting in the nearshore (between 5m and 9m LAT). Depending on the final design and depth of the ducts, there would be up to a 50m separation between adjacent drill HDD exit points.

2.5.139 The HDD would be started on land and directed out to sea, to avoid disturbance of the SSSI and coastal cliffs and beach. Each drill would reach up to 25m at their maximum depth. For each borehole a pilot hole will be drilled and then widened to the full diameter required. The primary HDD activity that interacts with the marine environment is when the HDD breaks through the sediment (or punches out) onto the seabed. During the HDD punch out, drilling fluid and cuttings would be released from the bore on to the seabed.

2.5.140 The drilling fluids to be used for the HDD are likely to be a modified bentonite, a biodegradable drilling fluid additive, a modified natural cellulosic polymer, soda ash (sodium carbonate) and a natural biodegradable polymer which does not contain synthetic polymers, and a solidification reagent (or similar). All products used would be certified as being environmentally friendly. Bentonite is classified by the Centre for Environment, Fisheries and Aquaculture Science (Cefas) as posing little or no risk to the marine environment.

2.5.141 The volume of drilling fluid and cuttings lost during punch out is minimised by several factors including the boreholes having been drilled to their maximum diameter prior to out and the continuous removal of drilling fluid and cuttings prior to punch out. Lower drilling fluid pumping rates are also used during punch out to minimise the loss of drilling fluid. Fresh water may replace drilling fluid for the last 10m as another mitigation to avoid excessive release of drilling fluid at the punch-out position. Discharges are estimated to occur on three separate days.

2.5.142 An excavated ‘exit pit’ may be required at the HDD exit points to clear unconsolidated sediment layers that may jam HDD equipment during punch out or prevent duct installation once the bores have been drilled. This excavation would be undertaken by either a backhoe excavator (barge mounted) or a controlled flow excavator. Up to three excavation pits may be required measuring up to 15m x 15m per duct. Sediments would be cleared and would not be removed from site. Exit pits would be refilled via a combination of manual infilling (backhoe excavator) and natural backfilling. Rock placement will not be used in the nearshore area.

2.5.143 Following drilling of the bores, HDPE liners (ducts) would be installed in each bore. Three construction methods are being considered: pulling the ducting from either onshore or offshore and pushing the ducting through the bores from onshore.

2.5.144 The method that involves the most marine activity is a pulled installation from onshore. This would require a completed HDPE duct to be floated to the HDD exit point and pulled through the bore to the HDD entry point in the onshore TJB. Floating the HDPE liners would involve several vessels and tugs.

2.5.145 A jack-up barge, spud-barge or multi-cat would be on site at the HDD exit for a period of two-to-three weeks. This is to support the installation of the HDPE liners as they are pushed or pulled through the bores. The vessel(s) would be equipped with cranes, winches and dive support facilities. Other vessels used at this time may include a guard vessel, crew transfer vessels, diver support vessel, and tugs.

2.5.146 Depending on the construction programme and any seasonal sensitivities at the proposed Landfall, there may be a break in works between the HDD finalisation and pulling the cables through the ducts (cable pull-in). If a break in works is necessary and exceeds a few months, it is good practice to blank off the duct and pull the duct back to seabed level or 0.5m below seabed level. The offshore end of the cable ducts would be 'wet stored' for this period by fitting a temporary flange to stop water ingress. This would be either a blanking plate (flat plate) or a marine bellmouth with a blanking plate or cover.

2.5.147 A marine bellmouth is a cone type structure, as illustrated in **Inset 2.7**. It supports the cable as it is pulled into the duct, ensuring that the cable does not snag on sharp duct edges or bend too far. The duct ends would then be stabilised, either by burial into the seabed, or through the temporary deposit of concrete mattresses or rock bags.

2.5.148 To prepare for the cable pull-in, any seabed deposits would be removed from the ducts. Any deposits would be fitted with lifting rings, which divers would fit from the surface deck crane. If the ducts have been buried into the seabed, they would be exposed using a barge mounted excavator, hydraulic dredge pump or CFE. Once the marine bellmouth or flange is exposed, temporary bags of sand, rock or grout could be placed underneath the marine bellmouth to keep it raised off the seabed and prevent ingress of sediment into the marine bellmouth during works. Any temporary deposits would be removed prior to the ducts being buried after cable pull in.

Inset 2.7: Example of a marine bellmouth

2.5.149 A messenger wire would be fed through each HDPE duct from the HDD compound. The messenger wire would be attached to a winch within the HDD compound. The cable lay vessel would approach the proposed Landfall position at approximately the 10m water depth contour. The cable end would be transferred to a multi-cat or construction support vessel and the cable end sailed to the messenger wire at the HDD duct exit. Floats would be installed along the cable to keep it from sinking to the seabed. Where the float in distance from the cable lay vessel to the HDD exit is short, floats may not be required. Workboats would be positioned along the length of the floating cable to ensure the steady positioning of the cable as it enters the duct.

2.5.150 The onshore winch would start to pull the cable through the duct. Divers would remove the floats as the cable approaches the duct, allowing the cable to sink and be pulled through the duct. Floats will be retrieved by a support boat. **Inset 2.8** shows an example of cable being pulled in to shore, photos taken from the Viking Link Project.

Inset 2.8: Example of cable pull in

Source: NGV Viking Link Project

2.5.151 A coffer dam will not be used for the proposed Landfall enabling works.

Proposed Offshore Scheme HDD Frac-out

2.5.152 Frac-out is the term for an unintentional or inadvertent loss of drilling fluid during the drilling of the boreholes. This occurs when a fracture in the underlying geology is encountered and drilling fluid finds an alternative escape path, rather than returning to the drill entry point for re-use and recycling. Drilling fluid can either be lost in the geological formation or can emerge at the surface. When released on an intertidal or subtidal surface drilling fluids are rapidly diluted, dispersed and break down in the marine environment.

2.5.153 The components of the drilling fluid, including bentonite, are not hazardous to the aquatic environment (biodegradable, does not bioaccumulate and is not toxic) and if released at the surface either in the intertidal or subtidal area, would not have any adverse effect on water quality or the environment.

2.5.154 Most frac-outs are of small quantities of drilling fluid. However, if there were to be a large release this could be visible as a plume in the marine environment for a short period (typically the length of the tidal cycle over which the release is occurring). Once drilling fluid is in contact with sea water, sodium chloride molecules (which are present in salt sea water) would react with the clay particles and polymers of the bentonite.

2.5.155 The particulates in bentonite flocculate on contact with seawater. Immediately after this flocculation, the bentonite particle shrinks and becomes a flat platelet (de-flocculation). The seawater would discolour at the outbreak, but the particles would be mixed by tidal and wave driven currents and dilute over time and with distance from the outbreak so that any discolouration would be localised. Once the drilling fluid is diluted, the clay and polymer molecules would be separated from the freshwater component of the drilling fluid and would be broken down into such small particles they would no longer be visible by human eye. Dilution would continue during the following one-to-two tidal cycles until the discolouration disappears.

Proposed Offshore HVDC Cables Installation

Cable Laying

2.5.156 When the cable lay vessel arrives on site the cable would be transported via cable engines from the carousels on the deck to the over-boarding point usually located at the stern of the vessel. Under tension the cable would be guided over a chute into the water. It would either be laid directly on to the seabed for later burial or would be directed into a burial tool for burial into the seabed.

2.5.157 There are three possible configurations for cable installation:

a. Pre-cut trenching – A pre-cut trenching vessel would tow a plough along the seabed creating a v-shaped trench. A separate cable lay vessel would follow, laying the cables directly into the trench. It would generally be followed by another construction support vessel towing a back-fill plough which would push the spoil heaps into the trench, covering the cables.
b. Simultaneous lay and burial – This technique would simultaneously create a trench excavation and lay the cable into the trench at the same time. The cable lay vessel may tow the burial equipment or it would be deployed by another vessel following close behind, creating effectively a single large spread. The cables would be fed into the burial equipment directly from above and the cables would be buried as the spread progresses along the route.
c. Post-lay burial – The cable lay vessel would lay the cables on the seabed and a post-lay burial vessel would follow later to bury the cables. As the post-lay burial is a stand-alone operation, the post-lay burial vessel may operate with a longer separation distance from the cable lay vessel, so there would be two operations separated physically by distance and in time.

2.5.158 While cable installation is being undertaken a safety zone would be in place around construction vessels; typically, 500m in radius to allow safe manoeuvring of the installation vessel. This would be extended to cover the footprint of an anchor spread if one is used. Depending on the burial tool used the vessels would be moving at indicative speeds of 50 to 400m or 500m per hour during cable lay and burial. The cable laying operations can generally continue in weather conditions up to force 7 winds and waves heights of up to 3m.

2.5.159 If the weather is more severe, and the vessels can no longer remain on station, there are two options:

a. The cable lay vessel will continue to slowly lay the cable onto the seabed, against the wind. After riding out the storm, the length of the cable laid during the storm would be retrieved from the seabed and cable lay operations started again from the point of suspension.

b. If the weather is too severe, it might be necessary for the cable lay vessel to cut the cable and leave the site until it is safe to return. This would be considered as a last resort. On return, the vessel would retrieve the end of the cable, make a joint and then continue the laying operation.

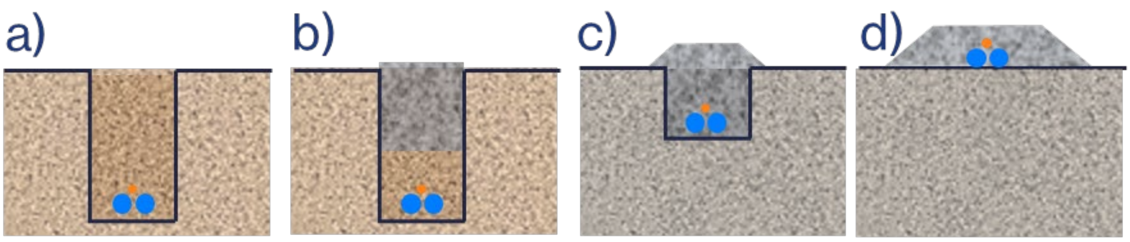
2.5.160 Cable lay and burial operations typically operate 24 hours a day to maximise the vessel and equipment time, and minimise disruption to shipping channels, fishing grounds or any other sensitive areas.

Burial Depths

2.5.161 Burial in the seabed is recognised as the best protection method for offshore HVDC cables. However, ground conditions may not always allow full cable burial to the depth necessary to protect from external risks. The cables would be buried below the seabed wherever possible, with a target burial depth defined post-consent in a pre-construction CBRA and Burial Assessment Study (BAS) undertaken by the cable installation contractor. The minimum and maximum cable burial depth would vary along the Proposed Offshore Scheme, depending on numerous factors such as soil type, presence / absence of subcropping or outcropping rock, shipping and fishing activity and type of burial tools used.

2.5.162 Information on seabed conditions provided by the 2024 geophysical and geotechnical surveys has indicated ground conditions along the proposed Offshore HVDC Cable Corridor which will limit the burial tools that can be used, and full burial may not be possible. **Inset 2.9** presents the various cable burial and protection scenarios that may be encountered along the proposed Offshore HVDC Cable Corridor.

Inset 2.9: Cable burial and protection scenarios



a) Target depth of burial achieved - full burial in sediment.
b) Target depth of burial achieved - insufficient natural backfill, cable protection required to seabed level.
c) Target depth of burial not achieved - additional cable protection required above seabed level to achieve adequate protection.
d) Cables surface laid - protection provided fully by external measures.

2.5.163 The design envelope for the Proposed Offshore Scheme, presented in **Table 2.22** is based on **Appendix 2.7 Outline Cable Burial Risk Assessment** of this PEIR and assumes that any and all of the burial tools outlined in **Paragraphs 2.5.164** to **2.5.175** would be available.

Table 2.22: Maximum Design Envelope for offshore cable burial

Parameter	Fully bundled solution
Length of cable (km)	Up to 182km
Length of route where cable burial in seabed can be achieved (km)	Unknown at this time. The length will be updated in the ES chapters.
Indicative maximum burial depth (m)	2.5m
Minimum burial depth	0m (see external cable protection requirements in **Table 2.23**)
Maximum installation tool seabed disturbance width (m)	15m
Maximum trench width (m)	5m
Maximum area of seabed disturbed by cable installation (m^2)	2,730,000m^2
Maximum area of seabed disturbed by cable installation (km^2)	2.730km^2
Maximum volume of sediment disturbed by cable installation (m^3)	6,825,000m^3

Burial Tools

2.5.164 There are a range of burial tools and techniques that can be used to bury the Proposed Offshore Scheme. The selection of the tool is based on numerous factors including the seabed geology and mobility, burial depth to be achieved, the installation contractor selected, proximity to existing infrastructure and environmental sensitivities and mitigation defined during the assessment process.

2.5.165 For all burial techniques, machine function is controlled from the surface vessel via an umbilical cable. In shallow water, divers may be used to assist e.g. load cable into the machine.

2.5.166 The nature of the seabed, the target burial depth and the tool selection influences how successful the first attempt at burying the cable is. Additional passes (i.e. where the burial equipment makes a number of attempts at burying the cable to get it deeper each time) would be made where the target burial depth is not achieved on the first attempt.

2.5.167 The following sub-sections describe the burial tools that could be used.

Cable Plough

2.5.168 Cable ploughs are used in non-cohesive soils such as loose coarse sand to fine dense sand and cohesive soils such as clay through to rock. They are either towed behind the cable lay vessel to simultaneously lay and bury the cables or towed by a separate vessel to bury the cables post-lay. An example is provided in **Inset 2.10**.

2.5.169 The cable plough would be positioned on the seabed with the cable fed into the front of the burial machine. The cable would be guided through the machine to a plough ‘share’ to emerge in the trench the share creates as it passes through the seabed. Soil displaced by the share is pushed to either side of the trench. The displaced soil may be simultaneously pushed by the plough back into the trench to cover the cables; pushed into the trench by a separate backfill plough; or left in place to naturally backfill the trench via natural seabed sediment movement.

2.5.170 The action of the plough causes a relatively large amount of ground disturbance (in comparison to other techniques such as jet trenching).

Inset 2.10: Example of a typical cable plough

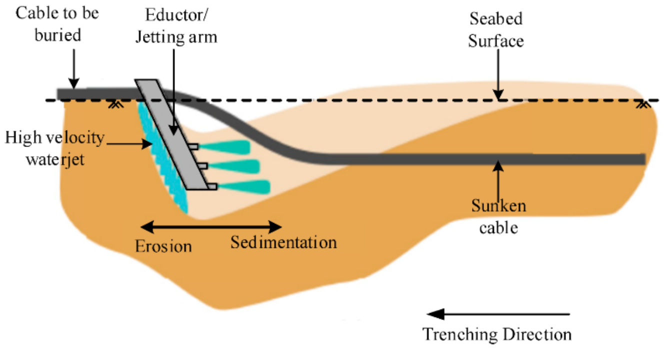
Source (Ref 6)

Jet trenching

2.5.171 These burial tools are tracked or remotely operated vehicles (ROVs) fitted with jetting swords. Most jet trenchers are self-propelled ROVs, although some can be towed from the cable lay vessel. The trencher would be lowered to the seabed above pre-laid cables. High pressure water is pushed through jetting swords into the seabed on either side of the cable, to fluidise the sediment. Lowering mechanisms allow the swords to be lowered into the seabed to the required burial depth, usually with a transition to the target depth of burial. The pre-laid cables sink through the fluidised soil to the bottom of the trench. The seabed sediments naturally re-form and back-fill the trench covering the cables. If the required depth of burial is not achieved, several passes can be made. A schematic is provided in **Inset 2.11**

2.5.172 Jet trenchers operate in unconsolidated sediments (sand, silt) and can achieve burial depths of up to 3m.

Inset 2.11: Schematic of the jet trenching method



Source: (Ref 7)

Cutting

2.5.173 Cutting is used on hard clay, cemented sand and weathered rock. It would be used to either create a pre-cut trench into which the cables would be laid, or post-laid. The burial machine is usually a tracked vehicle that uses chain saws or wheels armed with tungsten carbon steel to cut a defined trench. Soil from the trench is ejected by the cutting action to either side of the trench. This action may be augmented by eductors that suck cut spoil out of the trench and deposit it on either side. The open trench would be backfilled or left to refill naturally.

2.5.174 The operation is slower than other burial methods and typically requires more frequent maintenance stops.

Controlled Flow Excavation (CFE)

2.5.175 CFE, also commonly referred to as a Mass Flow Excavator (MFE), can also be used for the pre-sweeping of sand waves. The CFE is operated and directly connected to the installation vessel and is suspended over the seabed unlike the previous methods noted above which are on the seabed.

External Cable Protection

2.5.176 External cable protection may be required in various areas along the Proposed Offshore Scheme. Areas that require protection would include:

a. Infrastructure crossings; and
b. Areas where depth of burial cannot be achieved.

2.5.177 Preliminary review of the 2024 geophysical and geotechnical data has provided an indication of potential areas along the proposed Offshore HVDC Cable Corridor external cable protection may be required. The Outline CBRA (**Appendix 2.7** of this PEIR) sets out the routeing and burial risk considerations at this point in time and provides a starting point for the pre-construction CBRA that would be submitted in line with the anticipated dML conditions. The pre-construction CBRA will take into consideration, the Embedded Mitigation Measures, the final recommended target burial depths, the capabilities of the actual burial tools to be used, any contractual requirements such as the number of passes each burial tool is required to make to reach burial depth, as well as any new information on ground conditions.

2.5.178 Cable protection will be required at up to 24 infrastructure crossings, this cannot be avoided and is discussed in **Paragraphs 2.5.123** to **2.5.137.** With maximum design parameters shown in **Table 2.24**.

2.5.179 Information is currently unavailable to complete **Table 2.23** until completion of the CBRA and BAS. The maximum design envelope will be provided in the ES.

Table 2.23: Maximum design envelope for external cable protection (excluding infrastructure crossings)

Parameter	Fully bundled solution
Length of cable requiring cable protection (excluding infrastructure crossings)	To be confirmed
Length of cable requiring cable protection (excluding infrastructure crossings) (km)	To be confirmed
Maximum width of cable protection on seabed (m)	10m
Maximum height of cable protection berm (m)	1.5m
Total area of seabed covered by cable protection (m^2)	To be confirmed
Total volume of cable protection (m^3)	To be confirmed

2.5.180 The following sub-sections provided a description of the different materials that can be used to provide external cable protection.

Rock placement

2.5.181 Rock placement is used to protect offshore cables by covering the cable with a continuous berm of graded rock which would be profiled. The berm is typically made up of two layers, a filter layer and then a layer of armour. An example is provided in **Inset 2.12**.

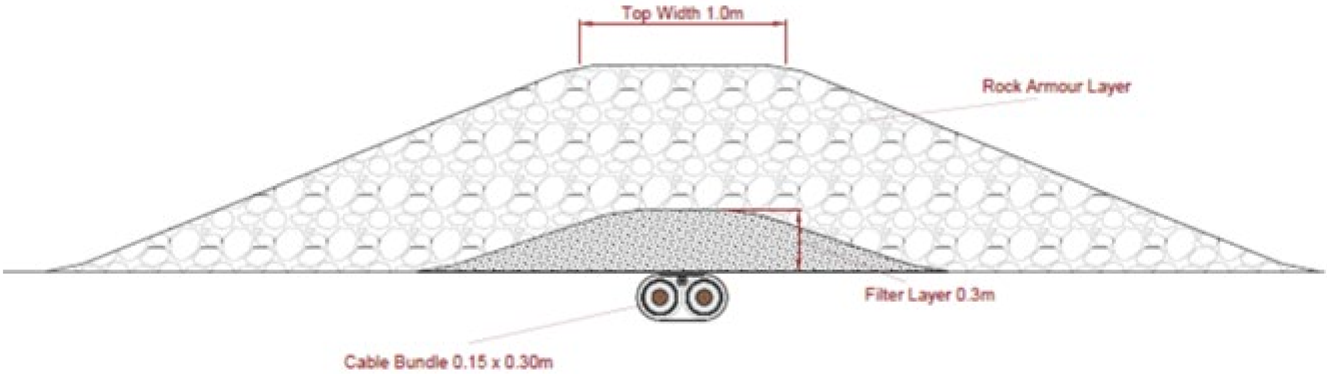
2.5.182 The filter layer is made of smaller particle size rock which is laid first to provide a stable layer for the armour layer which comprises of much larger size rock. The outer armour layer is designed to provide protection from external threats such as fishing gear or anchors as well as withstanding the metocean conditions.

2.5.183 Typically, the rock used would be an inert material such as granite to prevent the chances of non-native species being introduced to the area. The size of the berms will depend on the location of the berm and seabed conditions and will be individually designed.

2.5.184 The berm is typically constructed using a fall pipe vessel which would place rock over the cable.

Inset 2.12: Example schematic of a rock berm

Concrete mattresses



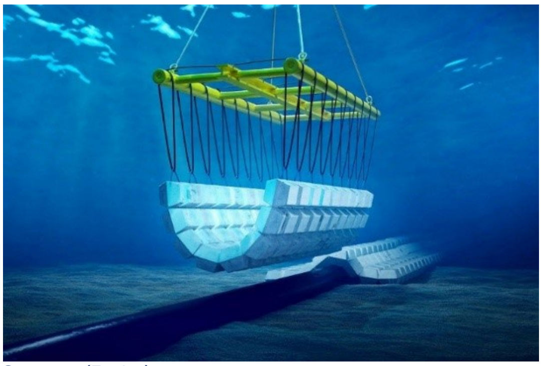
2.5.185 A concrete mattress comprises of matrices of interlinked concrete which are connected with rope and wire. They are installed using a crane from a construction support or diving vessel which would lower the mattress into position over the cable. An example is provided in **Inset 2.13**.

2.5.186 Concrete mattresses are typically 6m in length and 3m wide and provide a strong protective cover to prevent potential snagging of fishing gear or anchors. They are not as protective as rock berms and it is possible for the mats to be caught and dragged by anchors or moved by strong currents, so they cannot be used in all locations.

2.5.187 Typically for infrastructure crossings mattresses are used in combination with rock protection.

2.5.188 There are various companies in the market who are investigating alternative designs for concrete mattresses to make them more nature inclusive. Concrete blocks are designed with complex surface structures and textures to encourage marine life to colonise them once installed. An example is provided in **Inset 2.14.** The concrete may also include chemical additives which promote the growth of encrusting organism such as oysters and barnacles.

Inset 2.13: Typical concrete mattress



Source: (Ref 8)

Inset 2.14: Example of a nature inclusive concrete mattress

Source: (Ref 9)

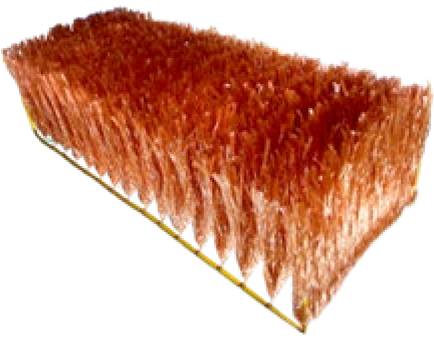
Flow dissipation devices

2.5.189 The purpose of a flow dissipation devices is to reduce the velocity of water passing over, encouraging sediment to drop out of suspension and accrete. They are often used to protect structures from erosion. The most commonly used devise is a fronded system / mat which can be either used on its own or attached to a concrete mattress. The system comprises of ultraviolet (UV) polypropylene fronds secured to a polyester webbing. Once laid they resemble seaweed which interrupts and reduces the velocity of the local currents. The drop in velocity allows the sediment to drop out of suspension and build up on the mats to form a natural embankment on and around the mat. Examples are provided in **Inset 2.15** and **Inset 2.16**.

2.5.190 Fronded mats are suitable to be used in areas where the seabed is primarily sand and would not be appropriate on a rocky seabed environment. The mats can be custom made but are typically 5m in length and 2.5m wide, with the fronds being up to 1.25m in length.

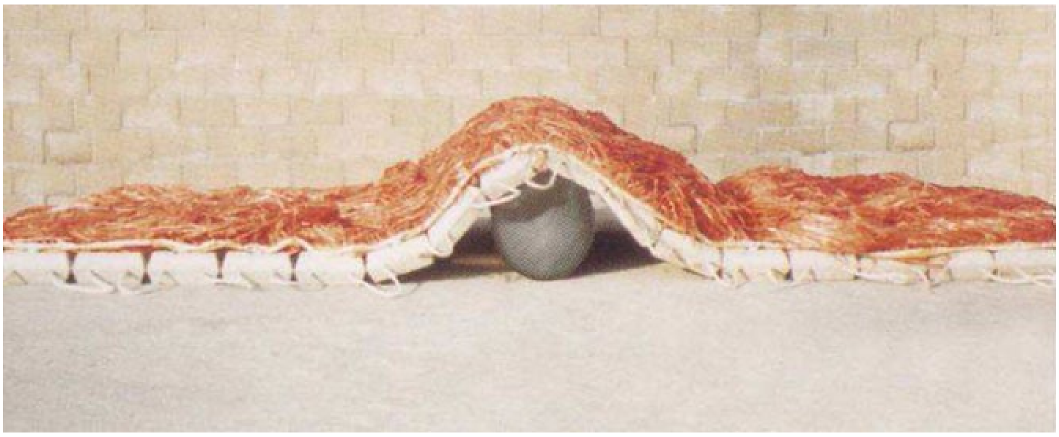
2.5.191 As technologies develop there are opportunities for fronded mats to be made of non-plastic products.

Inset 2.15: Example of fronded mat



Source: (Ref 10)

Inset 2.16: Example of fronded mat attached to a concrete mattress



Source: (Ref 11)

Protective coverings, claddings, or pipes

2.5.192 There are several varieties of protective coverings for offshore cables currently on the market such as Uraduct® or TekDuct, which are polyurethane half tubes which are used to enclose the cable bundle. They can include a ballast should the cable system need to be weighted down further.

2.5.193 There are also cast iron and concrete versions of the half pipe which can also be used. This type of protection is typically used in combination with another type of protection such as rock placement. However, it can be used as standalone method for short lengths of cable.

Rock Bags

2.5.194 Rock bags consist of various sized rocks (or sand and/or gravel) within a rope or wire netting bag, although there are new products coming on to the market whereby the bags are made from specially developed basalt fabric. They would be installed using a crane from a construction vessel placing them over the cable in the correct position.

Cable Jointing

2.5.195 Cable lay vessels are limited in the length of cable they can carry in a single load. Sections of offshore cables are connected by a cable joint. Each cable system would require multiple joints within the Proposed Offshore Scheme.

2.5.196 At the cable joint position, the end of the installed cable would be temporarily left on the seabed whilst the cable lay vessel returns to port to pick up a new cable length. A ground wire would be attached to the cable end to enable retrieval when the cable lay vessel returns. The cable end may be temporarily buried into the seabed, marked with a buoy and / or guarded by a guard vessel whilst the cable lay vessel is offsite.

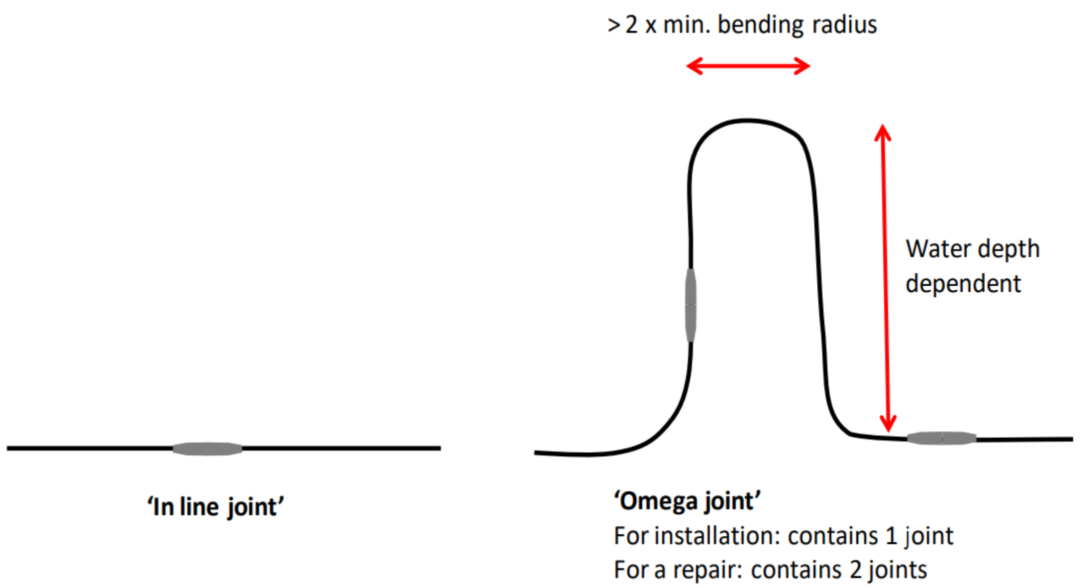
2.5.197 The cable joint would be made on board the cable lay vessel and would take up to two weeks per joint location. During this time the cable lay vessel would likely anchor to maintain position. Once the cable joint has been made, the cable lay vessel would continue to lay the new cable section.

2.5.198 In line joints would be made where cable laying can be continued after the cable end has been picked up. Where the cable is laid towards the cable end, or where a repair is required in an existing cable, an omega joint is made, as illustrated in **Inset 2.17**. For this joint, both cable ends are bought on board the cable lay vessel, to make the joint. The process requires extra cable, approximately equal to twice the depth of water to allow for the transition of each cable from the seabed to the surface to make the joint. When the cable is returned to the seabed the additional cable would be laid on the seabed to one side of the centreline in a loop.

2.5.199 For both types of joint, the joint and cables would be buried (as the preference) or protected by external cable protection.

2.5.200 It is assumed that the seabed footprint for cable jointing is within the design envelope for seabed preparation and cable installation described in **Paragraphs 2.5.110** to **2.5.137** and **2.5.156** to **2.5.175.** Cable Operations and Maintenance requirements are described in **Section 2.6**.

Inset 2.17: Illustration of subsea cable joints



Infrastructure Crossings

2.5.201 The works that would be undertaken to prepare the seabed for infrastructure crossings is described in **Paragraph 2.5.125**. This would involve installing a protective layer between the existing infrastructure and the Proposed Offshore Scheme.

2.5.202 An exclusion zone either side of the existing infrastructure would be agreed as part of the crossing agreement. The burial tool would transition out of the soil before reaching the exclusion boundary, and the Proposed Offshore Scheme would be surface laid over the infrastructure 'bridge' created during the seabed preparation works. A minimum vertical separation between the existing infrastructure and the Proposed Offshore Scheme, typically 300mm, would be agreed with the asset owners, and the crossing engineered to achieve the agreed vertical separation. Burial (as applicable) would continue after cable lay progresses outside of the burial exclusion zone.

2.5.203 External cable protection would then be laid over the Proposed Offshore Scheme along the surface laid cable (including the zones where the Proposed Offshore Scheme transited out and into the soil). See **Inset 2.12** for an illustration of a typical crossing berm.

2.5.204 The physical crossing designs for each infrastructure crossing would vary according to, among other things, the size, type, location and burial state of the crossed asset, and the exclusion zone. However, the crossings would not exceed the maximum design parameters presented in **Table 2.24**

2.5.205 The total number of crossings required would be 18. This assumes that the two Norfolk Vanguard East export cables would be installed with a 50m separation distance between cables, and that the Proposed Offshore Scheme would be surface laid across the separation distance resulting in a maximum crossing length of 150m. Other crossings would be shorter, approximately 100m, but for the purpose of assessment 150m has been used for the maximum design envelope for all crossings.

2.5.206 If the Proposed Offshore Scheme is exposed for any period e.g., between cable lay and deposition of external cable protection, a guard vessel would be deployed.

Table 2.24: Maximum design envelope for infrastructure crossings

Parameter	Fully bundled solution
Total number of crossings required	18
Maximum length of crossing (m)	150m
Total length of cable crossings (m)	2850m
Maximum width of crossing (m)	14m
Maximum height of rock berm (m)	2.2m
Total area of seabed covered by cable crossings (m^2)	39,900m^2
Total area of seabed covered by cable crossings (km^2)	0.0399km^2
Total volume of cable protection required (m^3)	87,780m^3

Installation Vessels

2.5.207 The use of specific vessels such as the Cable Lay Vessel (CLV) or a Cable Lay Barge (CLB) will be confirmed once the installation contract has been awarded (post-consent).

2.5.208 Details of vessels deployed on similar cable installation projects to the Proposed Offshore Scheme have been used to inform the description of representative vessels.

2.5.209 It is expected that the following vessels would be used. Descriptions of the vessels are provided in the subsections below:

a. CLV;
b. CLB;
c. Anchor handling tug;
d. Jack-up barge (JUB);
e. Guard vessel;
f. Construction and dive support vessels; and
g. Rock placement vessels.

Cable Lay Vessel (CLV)

2.5.210 A cable lay vessel is a specialist vessel that is designed specifically to carry and handle long lengths of heavy cables. CLV's are equipped with dynamic positioning (DP) systems, which enable the vessel to be held very accurately in position despite the effects of currents and wind. An illustration of this type of vessel is shown in **Inset 2.18**.

2.5.211 The cable will be loaded on to powered turntables (carousels) on the back of the CLV at the cable production factory. The cable is transported in this manner to prevent any twists or kinks in the cable.

Inset 2.18: Example of a cable lay vessel

Source: (Ref 13)

Cable Lay Barge (CLB)

2.5.212 A cable lay barge is used in areas where the water depth is less than 10m where the CLV cannot operate. These shallow water operations are generally conducted upon flat top pontoon barges. These barges are fitted out with the necessary cable storage and working equipment. An example of this type of vessel is shown in **Inset 2.19**.

2.5.213 Typically, the CLB uses anchors to hold position, although it may also have spud legs – legs which can be jacked up and down allowing the barge to tether to the seabed if required. Each anchor (up to eight in total) from the barge could be up to 2m in length and will be deployed up to 800m from the vessel (within the Order Limits) to allow the barge to hold station during the installation works.

2.5.214 The CLB typically is assisted by a team of other vessels and possibly divers depending on the cable laying technique being used. The small vessels are used to move anchors, monitor traffic and guard the vessel spread.

Inset 2.19: Example of a cable lay barge

Source: (Ref 14)

Anchor Handling Tug

2.5.215 Dedicated anchor handling tugs may be used to support the CLB. They can move the anchors to allow the barge to propel itself within the proposed Offshore HVDC Cable Corridor. These specialised vessels are typically 30m in length and have the ability to work in the shallower depths of the nearshore area. An example of this type of vessel is shown in **Inset 2.20.**

Inset 2.20: Example of an anchor handing tug

Source: (Ref 15)

Jack-up Barge (JUB)

2.5.216 A JUB is a platform that generally has four to eight legs which can be adjusted for the sea conditions. A JUB is used in the intertidal and nearshore waters and is typically used during the HDD operations.

2.5.217 A JUB does not have its own propulsion system, so it is towed into position by a tug. An example of this type of vessel is show in **Inset 2.21.**

Inset 2.21: Example of a jack-up barge

Source (Ref 16)

Guard Vessel

2.5.218 Due to the size and manoeuvrability of the CLV or CLB there may be a requirement for a guard vessel to accompany it. The guard vessel or other construction support vessels maintain surveillance around the CLV/CLB to monitor traffic and will notify other vessels to keep away from the installation spread to avoid the potential threat of collision.

2.5.219 The guard vessel may also be used to warn fishing vessels from areas of the route that are temporarily unprotected during the gap between cable lay and burial or the installation of external cable protection, to avoid any snagging of fishing gear.

2.5.220 Guard vessels are typically quite small vessels and preferably locally sourced and crewed to the project location to ensure that they are familiar with areas they are guarding. They are frequently fishing vessels who are unable to fish their normal grounds due to the construction works. An example of a guard vessel is illustrated in **Inset 2.22.**

Inset 2.22: Example of a guard vessel

Source: (Ref 17)

Construction Support Vessels

2.5.221 There are several other types of support vessels which would be used during the construction of the Proposed Offshore Scheme. These are likely to include dive support vessels (DSV), crew transfer vessels, general construction support vessels (CSV) and small rigid inflatable boats (RIBs). The DSVs and CSVs will vary in size dependant on the type of activity they are required to do and the working conditions, they may also undertake several different roles on a project such as inspections for UXO or archaeology, PLGR, anchor handling or the placement of mattresses at crossing locations. An example is provided in **Inset 2.23.**

Inset 2.23: Example of a Construction Support Vessel

Source: (Ref 18)

Rock Placement Vessels

2.5.222 Vessels used for rock placement are highly specialised. They comprise of a large hopper to transport the rock and a mechanism for the deployment of the rock at the correct location. This can use the following techniques:

a. Side dumping where rock is pushed or tipped over the side of the vessel;
b. Split hopper where the hopper separates to allow the rock to fall straight through the vessel on to the seabed below; and
c. Flexible fall pipe where a retractable chute is used to accurately control a flow of rocks over the cable on the seabed.

Inset 2.24: Example of rock placement vessels - Side dumping and Flexible fall pipe

Source (Ref 19)

Indicative vessel movements

2.5.223 A condition of the dML would be for the installation contractor to confirm the number and types of vessels to be used during all phases of construction. **Table 2.25** provides an indication of the types of vessels to be used during construction based on experience on other projects. Vessels would typically transit in a linear manner along the proposed Offshore HVDC Cable Corridor. However, their port of origins are unknown at this stage and will not be known until an installation contractor has been appointed (post consent).

Table 2.25: Indicative vessel numbers

Construction Activity	Indicative vessel requirements
Pre-construction survey	2 x survey vessel
UXO Identification	2 x CSV
UXO Clearance	1 x CSV 1 x guard vessel
Boulder Clearance	1 x CSV
Sandwave Clearance	1 x TSHD
Crossing Preparation	1 x CSV 1 x rock placement vessel
PLGR	1 x CSV
Proposed Landfall enabling works	1 x JUB / multicat 1 x tug 1 x crew transfer vessel 4 x small workboats
Cable lay and burial	1 x CLV 1 x CLB 1 x CSV 2 x tug / anchor handler 10 x guard vessel

2.6 Indicative Operation and Maintenance Activities

2.6.1 At this Statutory Consultation stage, the parameters for operation and maintenance are still being developed and refined through the EIA process.

2.6.2 This section has been provided to give context to stakeholders of the expected nature and scale of operation and maintenance activities associated with the Proposed Scheme.

2.6.3 The maximum parameters that have informed this preliminary assessment are set out in **Section 2.3 Proposed Onshore Scheme** and **Section 2.4 Proposed Offshore Scheme**.

Proposed Onshore Scheme

Kiln Lane Substation

2.6.4 Once the Proposed Onshore Scheme is operational, Kiln Lane Substation would be operated as per NGET substation processes and procedures, with NGET as transmission operator being responsible for the operation and maintenance of all grid infrastructure, apart from those owned by NGV and SPR.

2.6.5 NGET and NGV will continuously remotely monitor Kiln Lane Substation; it is therefore anticipated that the substation would not be staffed continuously. Operational staff would generally attend the site once a week for a visual inspection undertaken by one to two persons. Scheduled minor maintenance would occur every six months for two days, undertaken by up to two staff. Major maintenance would be scheduled to occur every two years, for a duration of four days, and undertaken by approximately 20 staff.

2.6.6 The external lighting system at Kiln Lane Substation would meet the requirements of National Grid TS 2.10.04 Issue 1- 2017. This specifies that the minimum exterior lighting requirements are as follows.

a. Maintained average illuminance: 6.0 lux.
b. Maintained minimum point Illuminance: 2.5 lux

2.6.7 The external lighting would allow the safe movement of vehicles and pedestrians between any two points that they may reasonably be expected to negotiate during the hours of low light or darkness within the site perimeter. The external lighting is not intended to facilitate maintenance activities for which it is assumed that additional portable equipment would be employed.

Proposed Converter Station

2.6.8 Following a period of commissioning and testing, the proposed Converter Station would operate continuously throughout the year. Direction of power flows (converting DC to AC, or converting AC to DC) across the link would depend on supply and demand on the transmission system. It is expected that the proposed Converter Station would be in operation 24 hours a day all year round. The only exception to this would be in the event of an unplanned outage or scheduled maintenance activities.

2.6.9 Daily staffed operational activities associated with the proposed Converter Station are typically expected to occur from Monday to Friday within the hours of 08:00 and 16:00, with some weekend activity as required. The proposed Converter Station would be operated by a team of up to 12 persons based on site. Should visitors attend the proposed Converter Station, total expected persons on site for an average week would be 20. During periods of major outage maintenance, staff presence at the proposed Converter Station would increase to approximately 50 persons.

2.6.10 Maintenance activities at the site would follow a maintenance schedule and could include visual and physical inspections, testing, repairing or replacing equipment as necessary. The typical maintenance regime for the proposed Converter Station is anticipated to include daily and weekly equipment checks in accordance with manufacturer recommendations, in addition to major planned annual maintenance periods typically comprising a two week scheduled outage to refurbish and replenish assets as required. In the unlikely instance where large components require replacement, abnormal load movement on local roads would be coordinated in agreement with the Local Planning Authority.

2.6.11 External lighting would be installed on the perimeter and within the proposed Converter Station for safety and security purposes and to facilitate maintenance or repair works during the hours of darkness or low light, although the proposed Converter Station would not normally be lit. Additional temporary task lighting would also be used in any area in which maintenance or repair works are necessary.

Proposed Underground HVAC Cables and proposed Underground HVDC Cables

2.6.12 During operation, the proposed Underground HVDC Cables and proposed Underground HVAC Cables would transmit electricity to and from the National Grid Transmission System, via the Kiln Lane Substation, depending on the supply and demand between the UK and the Netherlands at any given point in time.

2.6.13 Maintenance activities would involve:

a. Monthly cable route inspections, likely by two operational staff members, from locations where the route is close to or intersects the existing road network, and/or non-intrusive surveys (such as drone surveys) scheduled at monthly intervals to monitor the easements and any potential third party activities that could impact on the buried cables.
b. Sheath testing (on the proposed Underground HVAC Cables only) at 18-24 month intervals. This testing can be phased to occur during periods that work best with landowners.

2.6.14 In the very unlikely event that a proposed Underground Cable fault occurs (i.e., a cable strike), cable repairs may be required. The activities involved would be similar to installation, typically limited to the location of the repair. Depending on the severity of the fault, repairs could range from use of specialised sheath repair similar in nature to a joint bay unit, to full replacement of the cable section between joint bays.

2.6.15 No new permanent access roads are required for the proposed Underground HVAC Cables and the proposed Underground HVDC Cables. Operational and maintenance access or emergency repairs would be agreed with permanent easements.

Proposed Landfall

2.6.16 After construction and reinstatement the proposed Landfall Site would be returned to its previous use.

2.6.17 During operation and maintenance, maintenance regimes at the proposed Landfall Site would be similar to that of the proposed Underground Cable Corridor inspections. Monthly visual inspections would be undertaken with operatives using the existing road network and parking provisions.

2.6.18 No new permanent access roads are required at the proposed Landfall Site. Operation and maintenance access would be covered under the heads of terms negotiated for the permanent easement or via access secured through the application for development consent.

Emissions

2.6.19 Emissions that may occur during operation of the Proposed Onshore Scheme have been considered and controlled through the design evolution of the Proposed Onshore Scheme. These include electromagnetic field (EMF), heat and noise.

Electromagnetic Field

2.6.20 **Appendix 2.3 Electromagnetic Field Assessment** of this PEIR details the potential sources of EMF which have been considered as part of the EIA.

2.6.21 Consideration of the effects of EMF on relevant sensitive ecological receptors and human health is presented in **Chapter 8 Ecology and Biodiversity**, and **Chapter 10 Health and Wellbeing** of this PEIR respectively.

Heat

2.6.22 The proposed Underground HVAC Cables and proposed Underground HVDC Cables are potential sources of heat. The design of these cables, as detailed in **Section 2.3,** would prevent heat emissions that would lead to likely significant environmental effects. Therefore, heat sources have not been considered further within the preliminary Onshore EIA presented in **Chapters 6 to 17** of this PEIR.

Noise

2.6.23 Noise generating activities during the operational phase of the Proposed Scheme are the operation of the proposed Converter Station and Kiln Lane Substation, and respective supporting infrastructure.

2.6.24 A preliminary operational noise assessment has been undertaken and reported in **Chapter 15 Noise and Vibration** of this PEIR.

Proposed Offshore Scheme

2.6.25 The Proposed Offshore Scheme would be designed to minimise any maintenance requirements. Following installation, routine maintenance of the proposed Offshore HVDC Cables is not anticipated. However, 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.

In-service Offshore Survey Operations

2.6.26 Periodical geophysical inspection surveys would be undertaken to monitor cable burial and the status of external cable protection e.g., remedial or at infrastructure crossings. If results of the survey show that the Proposed Offshore Scheme are not at the required burial depth or has become exposed, remedial works could be undertaken as described in **Paragraphs 2.6.28** to **2.6.36**. Additional surveys may be undertaken after a storm passes over the proposed Offshore HVDC Cable Corridor which exceeded the design conditions.

2.6.27 Surveys would use the standard suite of geophysical techniques described in **Paragraph 2.5.94** (i.e., multibeam echosounder, sidescan sonar, sub-bottom profiler, magnetometer etc). Nearshore and offshore surveys vessels or an automated underwater vehicle (AUV) would be used.

Cable Repair

2.6.28 Should a fault be identified by the cable monitoring system in the cable(s) it would be necessary to identify the relevant location of the fault and retrieve the cable to the surface for inspection of the damage and replacement. The most common reason for repair of a offshore cable is damage caused by third parties, typically caused by vessel anchor strikes on a shallow or exposed cable segment.

2.6.29 A cable repair would typically be carried out by up to three vessels. For a shallow water repair, in less than 10m of water, an anchored barge would typically be used. In deeper water a DP cable vessel would be used. Vessels carrying out cable repair operations are restricted in their ability to manoeuvre and divers and/or ROV would be expected to be used with associated vessels.

2.6.30 The actual operational details and the precise configuration of a repair spread would depend on the type of repair identified. The typical steps would comprise:

a. Loading of spare cable to the repair vessel;
b. Survey to locate the damaged cable;
c. Cable de-burial;
d. Cable cutting and recovery to the surface;
e. Splicing in the replacement section of cable; and
f. Re-deployment of cable onto the seabed and re-burial.

2.6.31 A repair requires insertion of additional cable and two additional cable joints. The additional cable length may be equal to or greater than approximately three times the depth of the water at the site, depending on how much damage the cable has sustained.

2.6.32 If the repair is of a single cable in a bundled pair, the pair of cables would need to be cut and both brought to the surface. However, it is possible that both cables might be repaired as a precaution against undetected damage.

2.6.33 The extra length of a repaired cable section means that the repaired cable cannot be returned to its exact previous position and alignment on the seabed. The excess cable would be laid on the seabed in a loop to one side of the original route to form an 'omega' loop, as illustrated in **Inset 2.17**. This new piece of cable is then buried into the seabed, or external cable protection is deposited if burial is not feasible due to ground conditions or position.

2.6.34 A cable repair operation would be expected to take between six to twelve weeks depending on the type and extent of the damage, the burial requirements and operational constraints such as weather.

2.6.35 The requirement for repair operations during the lifetime of the Proposed Offshore Scheme would depend on the number of faults, location of the faults, and the burial/protection method used for the original installation.

2.6.36 The occurrence of a cable fault is influenced by unpredictable variables, including environmental conditions, installation quality, and external impacts such as fishing activities, deliberate damage or natural disasters. Historical data on similar interconnector projects may not be directly applicable due to differences in design, location, and operational conditions. These unpredictable factors make it unfeasible to provide an accurate estimate of future cable faults.

2.6.37 **Table 2.26** provides the maximum design envelope considered within the assessment for repairs.

Table 2.26: Maximum design envelope for cable repairs

Parameter	Value	Comment
Maximum length of cable requiring replacement per repair (km)	1km length	Assumes 1km for each cable in the trench.
Maximum length of cable requiring cable protection per repair (km)	700m	Assumption is that priority would be given to omega loop being buried. Cable protection would only be used if ground conditions prevent cable burial.
Maximum width of cable protection on seabed (m)	8m	
Maximum height of cable protection berm (m)	0.8m	Height above the seabed
Total area of seabed covered by cable protection per repair (m^2)	5,600m^2	

Emissions

2.6.38 The emissions that may occur during cable installation or operation are:

a. Electric and magnetic fields;
b. Heat; and
c. Underwater sound.

Electromagnetic fields (EMF)

2.6.39 All equipment that generates, transmits, distributes or uses electricity produces EMFs. The Proposed Offshore Scheme uses Direct Current (DC) technology which has a frequency of zero Hertz (0 Hz) and will produce static EMFs.

2.6.40 Electric fields depend on the operating voltage of the equipment producing them and are measured in V/m (volts per metre). As the Proposed Offshore Scheme cables are enclosed in a solid metal sheath, which screens the electric fields, they do not produce an external electric field. However, they do produce a magnetic field, which is not screened by the metal sheath, and as seawater moves through the magnetic field a small localised electric field is produced. This is known as an induced electric field.

2.6.41 Magnetic fields depend on the electrical currents flowing, which vary according to the electrical power requirement at any given time and are measured in μT (microtesla). Magnetic fields generated by the operational cables diminish rapidly with distance from the source.

2.6.42 The earth also produces its own DC magnetic field, which in the UK is around 49.9μT, but this can vary due to geomagnetic material such as ferromagnetic rocks. Given the natural magnetic field, the background induced electric field could range between 25.0 and 64.9μV/m in tidal velocities ranging between 0.5m/s and 1.3m/s.

2.6.43 The estimated magnetic fields for the Proposed Offshore Scheme have been calculated for two cable configurations: bundled HVDC cables with co-located DMR; and three unbundled cables separated by 15m and buried to 25m at landfall. All calculations were performed assuming the current maximum circuit separation and minimum burial depth, and 100% load giving a worst-case scenario. The maximum magnetic field for each design option was calculated at vertical distances of 0m to 20m from the seabed, and horizontal drop off along the seabed. A worst-case (minimum) burial depth of 1m was used for all calculations. The assessment is provided in **Appendix 2.5 Electromagnetic Field Assessment** of this PEIR.

Magnetic Compass Deviation

2.6.44 Magnetic compasses, whether traditional magnetic needle designs or alternatives such as fluxgate magnetometers, operate from the Earth's magnetic field, and are susceptible to any perturbation to the Earth's magnetic field by other sources.

2.6.45 The Maritime and Coastguard Agency (MCA) in their response for the Proposed Scheme's **EIA Scoping Opinion** (Ref 1) stated that:

> *"There must be no more than a 3-degree electromagnetic compass deviation for 95% of the cable route and for the remaining 5% of the cable route there must be no more than a 5 degree electromagnetic compass deviation. If the MCA requirement cannot be met, a post installation actual electromagnetic compass deviation survey should be conducted for the cable in areas where compliance has not been achieved."*

2.6.46 The magnetic fields and compass deviation at the sea's surface were calculated for the Proposed Offshore Scheme for the same design scenarios considered by the EMF calculations. The assessments were performed using cable orientation and depth from bathymetry data. The orientation of the cables to north, separation and depth, as well as the current flowing in the cable, will all impact the extent a compass is deviated from the earth's magnetic north.

2.6.47 The compass deviation calculations assume that the cable is buried 1m below the seabed. The compass deviation calculation results are calculated at the sea surface. In practice the draft of any vessels will limit the sea depth that applies, and the compass is likely to be situated above the water line, both of which will reduce the compass deviation that will be found in practice.

2.6.48 The calculations, presented in **Appendix 2.5 Electromagnetic Field Assessment** of this PEIR**,** show that:

a. When the HVDC cables are bundled the MCA thresholds are not exceeded.
b. Within 300m of the shoreline where the HVDC cables are separated into individual ducts compass deviation will be > 5-degrees.

Heat

2.6.49 Operational HVDC cables emit heat due to the Joule effect, where electrical energy is converted into thermal energy. This heat emission can lead to localised temperature increases at the cable surface and the surrounding environment. The extent of heat emission is influenced by factors such as the physical characteristics, type, load, and electrical tension of the cable, burial depth, sediment characteristics (thermal conductivity, thermal resistance), and environmental conditions such as water flow (Ref 4, Ref 20).

2.6.50 A literature review on thermal emissions was undertaken and is presented in **Appendix 2.6 Offshore Thermal Emissions Technical Note** of this PEIR. The review analysed various case studies where thermal modelling had been undertaken for comparable offshore cable systems. It shows that for cables operating at full power, temperature would be raised in the immediate vicinity of cables but reduces within increasing distance. The heat would be highly dependent on the depth of burial and the thermal resistance of the surrounding seabed. Temperature is likely to fluctuate as the cables would be unlikely to be operating at maximum capacity all the time or for extended periods of time (months/years).

Underwater Sound

2.6.51 The predominant noise generating activities during the installation and operations of the Proposed Offshore Scheme are from:

a. Geophysical survey equipment (e.g. side scan sonar, multi-beam echosounder, sub-bottom profiler);
b. Cable trenching (vessel and equipment noise);
c. Placement of external cable protection (vessel, equipment and rock placement noise);
d. Movement of vessels; and
e. Investigation and clearance of potential UXO (note clearance is subject to a separate Marine Licence).

2.6.52 UXO clearance is being consented via separate Marine Licence and is therefore not assessed in detail, a high-level assessment is provided only to ensure a holistic view of the whole project

2.6.53 The above activities include both impulsive and non-impulsive (continuous) anthropogenic sound sources:

a. Impulsive sounds include pulses generated during geophysical surveys or explosives used for UXO detonation. Which can be characterised by short duration pulses, broad bandwidth and have rapid rise and decay period with high peak pressures.
b. Non-impulsive sounds include the continuous sounds from vessel movements. Which can be characterised by low level sounds spread over a longer period of time that do not have a rapid rise and decay times or high peak pressures.

2.6.54 Acoustic modelling has been undertaken to determine distances at which potential effects on marine mammals and fish may occur due to noise from relevant underwater noise generating activities associated with pre-construction, site preparation and construction, as well as operations and maintenance and decommissioning of the Proposed Offshore Scheme. **Appendix 22.1 Underwater Noise Modelling Report** of this PEIR presents the results.

2.7 Indicative Decommissioning Activities

2.7.1 At this PEIR stage, the parameters for decommissioning are still being developed and refined through the EIA process.

2.7.2 This section has been provided to give context to stakeholders of the expected nature and scale of activities associated with the Proposed Scheme.

2.7.3 The maximum parameters that have informed this preliminary assessment are set out in **Section 2.3 Proposed Onshore Scheme** and **Section 2.4 Proposed Offshore Scheme**.

Proposed Onshore Scheme

2.7.4 There are no plans to decommission the Proposed Scheme. Most components of the Proposed Scheme have a design life of 40 years; however, the lifespan of components may be extended with regular maintenance and refurbishment.

2.7.5 In the event that the authorised development, or part of it, is to be decommissioned at a future date, a written scheme of decommissioning would need to be submitted for the approval to the relevant planning authority. This would need to take place at least 6 months prior to any decommissioning works. A requirement for the written scheme of decommissioning will be included within the application for development consent.

2.7.6 In the event of decommissioning of the Proposed Scheme, it is proposed that underground components of the Proposed Scheme (namely Underground HVAC and HVDC Cables and associated infrastructure) would be left in situ. Overground components (Kiln Lane Substation and the proposed Converter Station) would be reused or recycled where reasonably practicable, or disposed of in accordance with relevant waste disposal requirements at that time. All above ground assets would be removed to foundation level and foundations capped, and permanent access roads would be left in situ to allow for site reuse by another developer.

2.7.7 It is anticipated that no additional land outside of the Draft Order Limits would be required for decommissioning of the Proposed Scheme.

2.7.8 The workforce required for decommissioning of the assets would be lower than the number required during construction.

2.7.9 Temporary site compounds and other enabling works would be required during decommissioning similar to that needed during construction. It is anticipated that the temporary site compounds required for decommissioning of the Kiln Lane Substation Site and the proposed Converter Station Site would be located in the same location as required during construction. Due to the anticipated reduced workforce required for decommissioning of the overhead line and underground cables, the locations of the temporary construction compounds should be reviewed at the time of decommissioning.

2.7.10 The working hours for decommissioning activities would be similar to those for construction with a total estimated duration of decommissioning of two years.

2.7.11 The requirements for vegetation clearance during decommissioning would be subject to the extent of vegetation present in proximity of assets at the time, and can not be accurately predicted at this time. Appropriate surveys would be undertaken at the time to inform clearance planning.

2.7.12 Any land no longer needed for operational purposes would be restored in accordance with a scheme agreed with the relevant local planning authority.

2.7.13 The environmental impact of decommissioning the Proposed Onshore Scheme would be assessed at the time of decommissioning in line with the legislation, and National Grid’s processes at the time. The environmental impact can therefore not be fully assessed until the environmental conditions at the time of decommissioning are established. In any event, it is not anticipated that impacts from decommissioning would present any greater environmental risk than any assessed impacts from the construction phase. Therefore, only a high-level assessment of the impacts of decommissioning are considered in the EIA. The approach to the assessment of decommissioning is set out in **Chapter 5 EIA Approach and Methodology** of this PEIR.

Kiln Lane Substation

2.7.14 The lifespan of substation equipment is approximately 40 years. If it was determined that elements of the Kiln Lane Substation were no longer required, they would be disconnected from the system before being dismantled and recycled or reused if possible. Where this is not possible, removed equipment would be disposed of in accordance with the relevant waste disposal regulations at the time of decommissioning.

2.7.15 It is likely the decommissioning methods would be similar to those required to install the asset. All above ground assets would be removed to foundation level and foundations capped.

2.7.16 It is not anticipated that impacts from decommissioning would present any greater environmental risk than any assessed impacts from the construction phase.

Proposed Converter Station

2.7.17 The anticipated operational life of the proposed Converter Station is approximately 40 years. It is likely that during this period refurbishment and plant replacement would extend the life of the proposed Converter Station rather than decommissioning. In the event that the Proposed Scheme ceases operation the proposed Converter Station would be decommissioned in accordance with a decommissioning plan that is expected to include but not limited to as follows:

a. dismantling and removal of equipment;
b. removal of cabling from the proposed Converter Station Site;
c. removal of any building services equipment;
d. demolition of the buildings and removal of fences; and
e. landscaping and reinstatement of the site

2.7.18 The main components would be dismantled and removed for recycling wherever possible. It will also be evaluated whether the buried cables systems could be used for another purpose. Where this is not possible disposal would be undertaken in accordance with the relevant waste disposal regulations at the time of decommissioning. It is anticipated that the permanent access road would be left in-situ whereas the above ground features would be removed to a sufficient depth to allow other practices/construction to occur unhindered.

2.7.19 If decommissioning is required, the scale and nature of activities would use similar methods as those required to install the asset with decommissioning separately assessed at the time.

2.7.20 It is not anticipated that impacts from decommissioning would present any greater environmental risk than any assessed impacts from the construction phase.

Proposed Underground HVAC Cables and proposed Underground HVDC Cables

2.7.21 If the Proposed Scheme is required to be decommissioned, the proposed Underground HVAC Cables and proposed Underground HVDC Cables would be decommissioned. Dependent on specific requirements the redundant cables could either be left in-situ, or all or parts of the cable could be removed for recycling. Where this is not possible, removed cables would be disposed of in accordance with the relevant waste disposal regulations at the time of decommissioning.

2.7.22 All above ground assets along the proposed Underground Cable Corridor would be removed to foundation level and foundations capped.

2.7.23 It is not anticipated that impacts from decommissioning would present any greater environmental risk than any assessed impacts from the construction phase.

Proposed Landfall

2.7.24 The expected minimum operational life of the proposed Landfall infrastructure is 40 years, with replacement of the telecommunication equipment expected after 25 years or upon the failing of specific assets.

2.7.25 Upon the decommissioning of the Proposed Scheme, the below ground transition joint bay providing onshore to offshore cable interface may be left in place. As a result, it is expected that there would be similar methods used as those required to install the asset with decommissioning separately assessed at the time.

2.7.26 It is not anticipated that impacts from decommissioning would present any greater environmental risk than any assessed impacts from the construction phase

Proposed Offshore Scheme

2.7.27 The life expectancy of the proposed Offshore HVDC Cables is 40 years, although with repairs, some cable systems last upwards of 60 years.

2.7.28 The environmental impact of decommissioning the Proposed Offshore Scheme would be assessed at the time of decommissioning in line with the legislation at the time. Removal of the cable is a similar process to the installation of the cable but in reverse. The environmental impact can therefore not be fully assessed until the environmental conditions at the time of decommissioning are established. In any event, it is not anticipated that impacts from decommissioning would present any greater environmental risk than any assessed impacts from the construction phase. Therefore, only a high-level assessment of the impacts of decommissioning are considered in the EIA.

2.7.29 An Initial Decommissioning Plan (IDP) would be written once the final route and installation methodology is chosen. This is a legal requirement necessary to secure the Crown Estate Licence (necessary for the laying of cables within territorial waters). he IDP would form the basis of the Final Decommissioning Plan which would be developed in consultation with The Crown Estate in line with the following decommissioning principles:

a. The measures and methods for any decommissioning would comply with any legal obligations which would apply to the decommissioning of the Proposed Offshore Scheme when it takes place;
b. All sections of the cables would be removed except for any section or sections which are preferable to leave in situ having regard to the principles below;
c. that the measures and methods for any decommissioning are the best for, or minimise the risks to:
d. the safety of surface or subsurface navigation;
e. other uses of the sea;
f. the marine environment including living resources; and/or,
g. health and safety.

h. The seabed would be restored, as reasonably as possible and to the extent reasonably practicable, to the condition that it was in before the cable was installed.

2.7.30 The IDP is periodically reviewed and updated in line with the applicable guidance and regulations at the time.

2.7.31 For the purposes of determining a design envelope, two scenarios have been considered. Firstly, that the Proposed Offshore Scheme would be removed in its entirety, with the same impact footprints as experienced during installation. Secondly, that all permanent seabed deposits e.g., remedial external cable protection and protection at crossings will remain in place and would not be removed.

Topic Glossary and Abbreviations

Term	Definition
AC	Alternating Current
ACSR	Aluminium Conductor Steel Reinforced
AIL	Abnormal and Invisible Loads
AIS	Air Insulated Switchgear
AOD	Above Ordnance Datum
BAS	Burial Assessment Study
CBRA	Cable Burial Risk Assessment
CBS	Cement Bound Sand
CCTV	Closed-Circuit Television
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CFE	Controlled Flow Excavator
CIGRE	Council on Large Electric Systems
CLB	Cable Lay Barge
CLV	Cable Lay Vessel
CSV	Construction Support Vessel
cUXO	Confirmed Unexploded Ordnance
DC	Direct Current
DCO	Development Consent Order
DDV	Drop down camera or remotely operated vehicle video
dML	Deemed Marine Licence
DMR	Dedicated Metallic Return
DOL	Draft Order Limits
DP	Dynamic Positioning
DSV	Dive Support Vessel
EA1N	East Anglia One North Offshore Windfarm Project
EA2	East Anglia Two Offshore Windfarm Project
EEZ	Economic Exclusive Zone
EIA	Environmental Impact Assessment
EMF	Electromagnetic Fields
ENTSO-E	European Network of Transmission System Operators
ES	Environmental Statement
GB	Great Britain

Term	Definition
GIBs	Gas Insulated Buses
GIS	Gas Insulated Switchgear
GW	Gigawatts
HDD	Horizontal Directional Drilling
HDPE	High Density Polyethylene
HV	High Voltage
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
Hz	Hertz
ICPC	International Cable Protection Committee
IDP	Initial Decommissioning Plan
IS	In Service
JNCC	Joint Nature Conservation Committee
JUB	Jack-Up Barge
kV	Kilovolt
LAT	Lowest Astronomical Tide
LoD	Limits of Deviation
LV	Low Voltage
MBES	Multi-Beam Echo Sounder
MCA	The Maritime and Coastguard Agency
MFE	Mass Flow Excavator
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMO	The Marine Management Organisation
NE	Natural England
NETS	National Electricity Transmission Systems
NGET	National Grid Electricity Transmission plc
NGV	National Grid Ventures
oCTMP	Outline Construction Traffic Management Plan
OHL	Overhead Line
OOS	Out Of Service
Open cut	Method of underground cable installation involving open excavation of topsoil and subsoil, placement of cable ducts and reinstatement over ducts before cable pulling.
OWF	Offshore Windfarm

Term	Definition
PEIR	Preliminary Environmental Information Report
PLGR	Pre-lay Grapnel Run
PRoW	Public Rights of Way
pUXO	Potential Unexploded Ordnance
ROV	Remote Operated Vehicle
SAC	Special Area of Conservation
SBP	Sub-Bottom Profiling
SPA	Special Protection Area
SPL	Sound Pressure Level
SPR	Scottish Power Renewables
SSS	Side Scan Sonar
SSSI	Site of Special Scientific Interest
TCC	Temporary Construction Compounds
TJB	Transition Joint Bay
Trenchless crossing	Method of underground cable installation using bore equipment from launch pit to reception site, for the purpose of avoiding constraints on the surface e.g. railway lines, watercourses.
TSHD	Trailing Suction Hopper Dredger
UXO	Unexploded Ordnance
XLPE	Cross Linked Polyethylene

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