The Great Grid Upgrade

Sea Link

# Sea Link

**Volume 9: Examination Submissions**

**Document 9.92: Outline Cable Specification and Installation Plan**

**Planning Inspectorate Reference: EN20026**

**Version: B**
**March 2026**

nationalgrid

Page intentionally blank

# Contents

## Table of Plates



## Tables of Tables

## Version History

| Date | Version | Status | Description / Changes |
|---|---|---|---|
| February 2026 | A | Final | For Deadline 4 submission |
| March 2026 | B | Final | For Deadline 5 submission |

# 1. Introduction

## 1.1 Background

1.1.1 This Outline Cable Specification and Installation Plan (CSIP) has been prepared for the Sea Link Project Offshore Scheme.

1.1.2 The Sea Link Project (hereafter referred to as the 'Proposed Project') is a proposal by National Grid Electricity Transmission plc (hereafter referred to as National Grid) to reinforce the transmission network in the South East and East Anglia. The Proposed Project is required to accommodate additional power flows generated from renewable and low carbon generation, as well as accommodating additional new interconnection with mainland Europe.

1.1.3 National Grid owns, builds and maintains the electricity transmission network in England and Wales. Under the Electricity Act 1989, National Grid holds a transmission licence under which it is required to develop and maintain an efficient, coordinated, and economic electricity transmission system.

1.1.4 This would be achieved by reinforcing the network with a High Voltage Direct Current (HVDC) Link between the proposed Friston substation in the Sizewell area of Suffolk and the existing Richborough to Canterbury 400 kV overhead line close to Richborough in Kent.

1.1.5 National Grid is also required, under Section 38 of the Electricity Act 1989, to comply with the provisions of Schedule 9 of the Act. Schedule 9 requires licence holders, in the formulation of proposals to transmit electricity, to:

- *Schedule 9(1)(a) "…have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest"; and*
- *Schedule 9(1)(b) "…do what [it] reasonably can to mitigate any effect which the proposals would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects."*

1.1.6 The Proposed Project includes the Offshore Scheme, which is a subsea HVDC cable across the outer Thames region of the southern North Sea, linking Suffolk to Kent. The Offshore Scheme includes three distinct components: the Suffolk landfall at Aldeburgh, the marine HVDC cable and the Kent landfall at Pegwell Bay.

### Purpose and Objectives of this Outline CSIP

1.1.7 This outline CSIP sets out the principles with which the final CSIP must substantially accord. The CSIP will be submitted for approval by the Marine Management Organisation (MMO) and is secured via condition of the Deemed Marine Licence in Schedule 16 of the draft Development Consent Order (DCO).

1.1.8 This CSIP pertains to the elements of the Proposed Project which are seaward of Mean High Water Springs (MHWS).

1.1.9 In accordance with the condition in the deemed Marine License (dML), the CSIP will include the following details.

## Table 1.1 Outline structure of the CSIP

| dML Condition | Where Addressed |
|---|---|
| (i) a sediment disposal management plan | The approach to sediment disposal is outlined in Section 8. |
| (ii) technical specification of offshore cables below MHWS, including a desk-based assessment of attenuation of electromagnetic deviation of the high voltage cable route, shielding and cable burial depth in accordance with industry good practice | The outline technical specification of the offshore cables is set out in Section 1.6.<br>The final routing of the Offshore Scheme will be influenced by the potential environmental impacts and the Cable Burial Risk Assessment (Section 4.3) |
| (iii) location and timings | Details related to location and timings are outlined in Section 1.3 and Section 1.7. |
| (iv) timings and duration of intertidal works | The approach to intertidal works is outlined within Section 2. |
| (v) a detailed cable laying and burial plan, incorporating a burial risk assessment to ascertain suitable burial depths and cable laying techniques | Potential cable installation methods, including pre-construction surveys and cable route preparation, are set out in Section 3 to Section 5. |
| (vi) a detailed cable protection plan; | The approach to cable protection is presented in Section 5. |
| (vii) details of intended boulder removal | The approach to boulder removal is presented in Section 3.3 |
| (viii) a marine pollution contingency plan | The approach to pollution prevention is presented in Section 9.1. |
| (ix) a waste management plan; | The approach to waste management in presented in Section 9.2. |

1.1.10 The Condition for a CSIP will be discharged in phases that align with the programme of works for the construction of the Offshore Scheme, including:

- Landfall installation.
- Seabed preparation (including crossings).
- Cable lay and burial.
- Post-lay cable protection.

1.1.11 The condition for a CSIP will not be fully discharged until the CSIP for post-lay cable protection is approved by the Marine Management Organisation (MMO) in consultation with the following stakeholders:

- Natural England (NE).
- Maritime and Coastguard Agency (MCA).
- Trinity House Corporation (TH).
- Port of London Authority (PLA).
- London Gateway Port Limited (LGPL).

1.1.12 Section 6 of this CSIP presents the approach to sediment disposal management in response to relevant representations and stakeholder discussions in relation to dredge and disposal material within the Order Limits. This section sets out the key constraints and measures proposed. The Marine and Coastal Access Act 2009 (MCAA) Section 66 states that it is a licensable marine activity to carry out any form of dredging and disposal of dredged material in the seabed within the UK. For the purposes of this document, 'disposal' means the deposited sediment at the seabed from seabed preparation activities listed in Section 3 of this document.

1.1.13 This Outline CSIP is a 'living document' that will be revised by the Contractor (with relevant input from the National Grid and Subcontractors), as required, at agreed intervals or at the request of the MMO in consultation with relevant stakeholders.

1.1.14 Updates to the CSIP may relate to changes in construction methodologies, new or updated mitigation measures, changes in guidance or legislative requirements, or to reflect newly identified environmental sensitivities ahead of construction. Any material updates to the CSIP will be communicated to the MMO, and if required, the CSIP will be re-submitted for approval.

1.1.15 The information used to draft this outline CSIP has been taken from **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project [REP1A-003].**

## 1.2 The Proposed Project

1.2.1 The Proposed Project would comprise the following elements:

### The Suffolk Onshore Scheme

- A connection from the existing transmission network via Friston Substation, including the substation itself. Friston Substation already has development consent as part of other third-party projects. If Friston Substation has already been constructed under another consent, only a connection into the substation would be constructed as part of the Proposed Project.
- A high voltage alternating current (HVAC) underground cable of approximately 1.9 km in length between the proposed Friston Substation and a proposed converter station (below).
- A 2 GW high voltage direct current (HVDC) converter station (including permanent access from the B1121 and a new bridge over the River Fromus) up to 26 m high plus external equipment (such as lightning protection, safety rails for maintenance

works, ventilation equipment, aerials, similar small scale operational plant, or other roof treatment) near Saxmundham.

- A HVDC underground cable connection of approximately 10 km in length between the proposed converter station near Saxmundham, and a Transition Joint Bay (TJB) approximately 900 m inshore from a landfall point (below) where the cable transitions from onshore to offshore technology.
- A landfall on the Suffolk coast (between Aldeburgh and Thorpeness).

### The Offshore Scheme

1.2.2 Approximately 122 km of subsea HVDC cable, running between the Suffolk landfall location (between Aldeburgh and Thorpeness), and the Kent landfall location at Pegwell Bay.

### The Kent Onshore Scheme

- A landfall point on the Kent coast at Pegwell Bay.
- A TJB approximately 800 m inshore to transition from offshore HVDC cable to onshore HVDC cable, before continuing underground for approximately 1.7 km to a new converter station (below).
- A 2 GW HVDC converter station (including a new permanent access off the A256), up to 28 m high (2m allowance for ground level rise plus 26m converter station) plus external equipment such as lightning protection, safety rails for maintenance works, ventilation equipment, aerials, and similar small scale operational plant near Minster. A new substation would be located immediately adjacent.
- Removal of approximately 2.2 km of existing HVAC overhead line, and installation of two sections of new HVAC overhead line, together totalling approximately 3.5 km, each connecting from the substation near Minster and the existing Richborough to Canterbury overhead line.

1.2.3 The Proposed Project also includes modifications to sections of existing overhead lines in Suffolk (only if Friston Substation is not built pursuant to another consent) and Kent, diversions of third-party assets, and land drainage from the construction and operational footprint. It also includes opportunities for environmental mitigation and compensation. The construction phase will involve various temporary construction activities including overhead line diversions, use of temporary towers or masts, working areas for construction equipment and machinery, site offices, parking spaces, storage, accesses, bellmouths, and haul roads, as well as watercourse crossings and the diversion of public rights of way (PROWs) and other ancillary operations.

1.2.4 This document is applicable to the Offshore Scheme.

## 1.3 Location

1.3.1 The proposed bundled marine HVDC cables would be routed from the TJB at the Suffolk landfall located at Aldeburgh and the TJB at the Kent landfall at located within Pegwell Bay to the south of the settlement of Cliffsend.

## 1.4 Areas of Safeguarded Water Depth

1.4.1 Cables will be designed, installed, maintained and operated so as not to preclude or impede dredging within the following Areas of Safeguarded Water Depth.

1.4.2 For the purposes of this outline CSIP, the three Areas of Safeguarded Water Depth agreed with the Port Authorities presented in Plate 1.2 are as follows:

a) Labelled “Sunk Pilot Boarding area”, to a level of 22 metres below Chart Datum;

b) Labelled “Long Sand Head Two-Way Route crossing area”, to a level of 12.5 metres below Chart Datum; and

c) Labelled " North East Spit area" to a level of 12.5 metres below Chart Datum.

1.4.3 In all cases (a) to (c) makes allowance for an ‘over-dredge’ tolerance of 0.5 metres in addition to the stated depths attributable to standard dredging methodology.

1.4.4 Within the North East Spit area, the water depth is also to be preserved following the crossing of the Proposed Project and the GridLink Interconnector Project either-

- Where the Proposed Project is installed first, by installing the Proposed Project at a depth that provides sufficient vertical clearance for the GridLink Interconnector Project to be laid over it and protected without compromising the depth protection; or
- Where the GridLink Interconnector Project is installed first, by using reasonable endeavours to ensure that the GridLink Interconnector Project cable is installed with sufficient vertical clearance to allow the Proposed Project to be installed subsequently without compromising the depth protection.

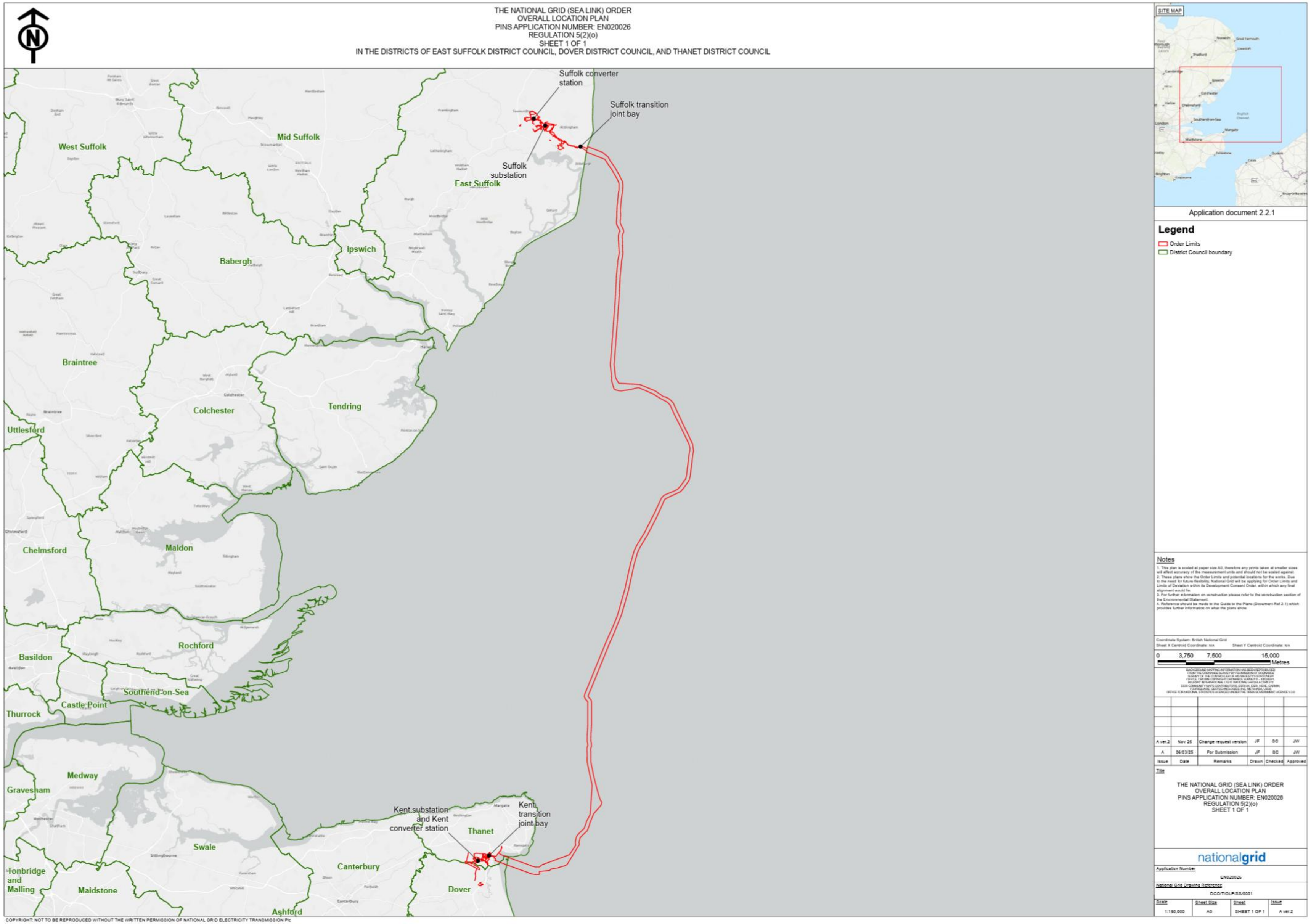
## 1.5 Environmental Principles

### Avoidance of Disturbance in Proximity to Sensitive Benthic Habitats

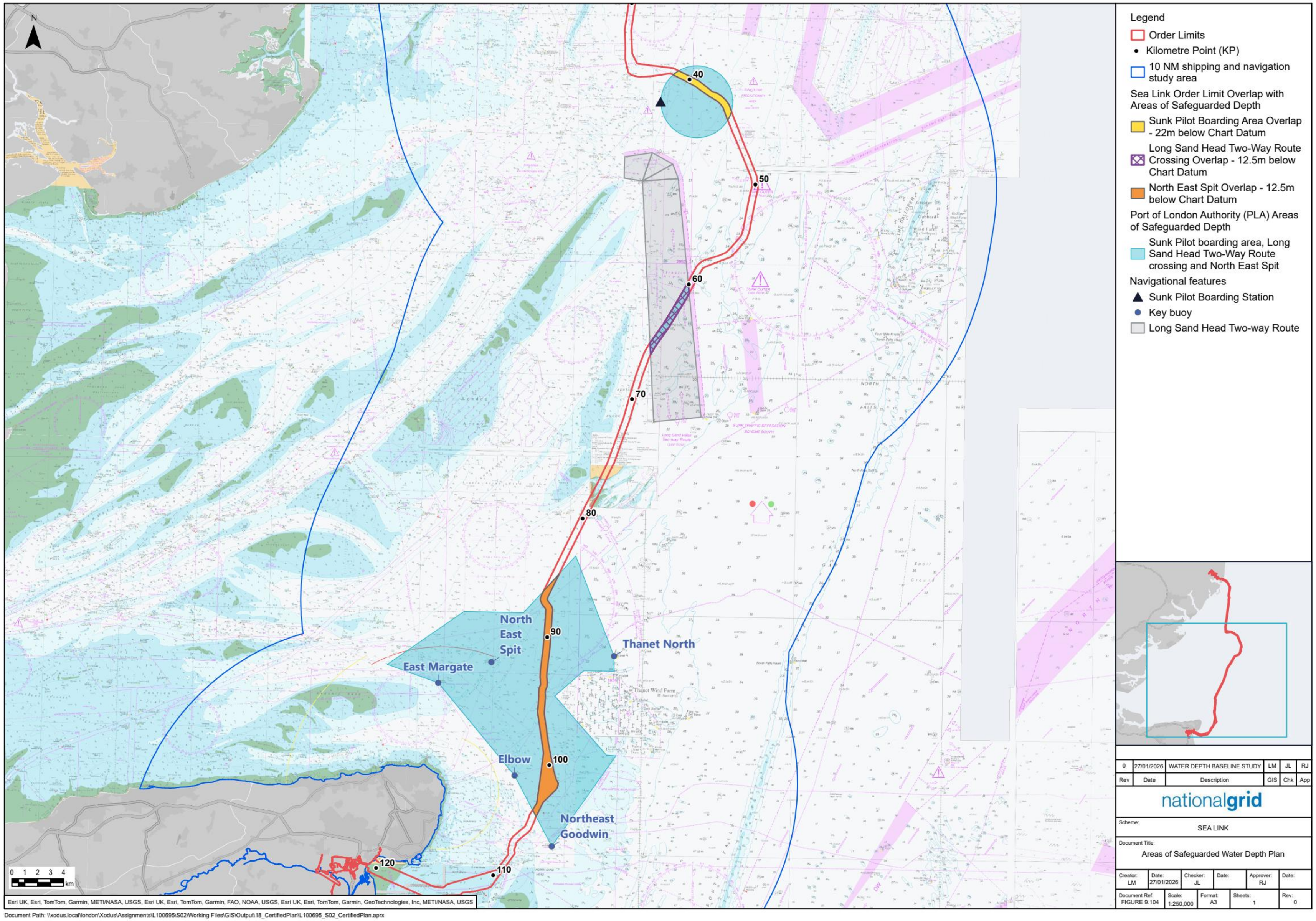
1.5.1 Cable installation will comply with **Application Document 7.5.2 Outline Offshore Construction Environmental Management Plan [APP-339]** and **Application Document 9.84 Register of Environmental Actions and Commitments (REAC) [TBC]**.

### Archaeological Exclusion Zones

1.5.2 Cable installation will comply with **Application Document 7.5.5 Outline Offshore Written Scheme of Investigation [PDA-033].**




## Plate 1.1 Location plan




## Plate 1.2 Port Areas of Safeguarded Water Depth

## 1.6 Cable Specification

1.6.1 The proposed bundled marine HVDC cables would be routed from the TJB at the Suffolk landfall located at Aldeburgh and the TJB at the Kent landfall at located within Pegwell Bay to the south of the settlement of Cliffsend.

1.6.2 The cable configuration for the Offshore Scheme is assumed to be two HVDC cables and one fibre optic cable bundled together in one trench. With a bundled approach, the two cables and the fibre optic cable would be combined into a single bundle.

## 1.7 Offshore Scheme Programme of Works

1.7.1 Indicative timings of the Proposed Project are outlined in **Application Document 7.5.2 Outline Offshore Construction Environmental Management Plan [APP-339].**

# 2. Description of Landfall Installation

## 2.1 Overview

2.1.1 The cable landfalls form the transition between the underground HVDC cable and the marine HVDC cable. The underground HVDC cable and marine HVDC cables are jointed together at the TJB located as close to the coast as possible whilst taking account of any environmental or technical constraints at a particular landfall.

2.1.2 Horizontal Directional Drilling (HDD) is the expected methodology to be used to carry out the landfall works, but other trenchless techniques may be considered.

## 2.2 HDD Installation Methodology

2.2.1 The basic HDD process involves the use of a drilling head controlled from the rig to drill a pilot hole along a predetermined profile to the exit point, which is then widened (reamed) using larger drilling holes until the hole is wide enough to accommodate the cable ducts.

2.2.2 The works at the landfalls include:

- Establish temporary construction access route (Kent Landfall only).
- Cofferdam Construction (Kent Landfall only).
- Installation of rig anchor.
- Installation of Temporary Casing.
- Pilot Drilling.
- Reaming.
- Duct Installation.
- Duct End Works.

2.2.3 Exit pits will be excavated or dredged to the required depth. An indicative area of seabed directly impacted by work associated with excavation of exit pits (incl. equipment spread) is 200 $m^2$, with a depth of 0 m - 2 m.

2.2.4 Cofferdams at the Suffolk Landfall are not included within the Proposed Project.

2.2.5 At both landfalls, HDD installation would be a 24-hour operation where viable to minimise overall installation time, maximise the use of suitable weather windows and take advantage of vessel and equipment availability.

## 2.3 Drilling Fluid Management

2.3.1 Drilling fluids would be used to suspend rock cuttings and carry them out of the borehole, cooling the drilling equipment, clearing debris from the drilling bit, sealing the borehole and reducing friction on the drilling equipment.

2.3.2 As set out under measure **GH10** within **Application Document 7.5.3.2 (B) CEMP Appendix B Register of Environmental Actions and Commitments (REAC) [REP3-078]**, the HDD contractor will produce a detailed, drilling fluid management plan to be approved by the MMO in consultation with relevant stakeholders including Natural England, that includes drilling fluid breakout mitigation measures, where HDD is proposed. This plan will include consideration of potential impacts on nearby archaeological remains and sensitive benthic ecology (both direct and indirect) as a result of drilling fluid breakout. The plan will be developed by the contractor. All relevant permits will be obtained or exemption/exclusions registered by the Main Works Contractor(s) for the use of drilling fluids / additives, as applicable.

2.3.3 The essence of the plan will be as follows:

- During pilot hole drilling the contractor will monitor the drilling fluid pressure several metres behind the drilling bit using sensors in the downhole steering and surveying tool. This monitoring will give immediate warning of any significant change of pressure that might indicate fluid loss or surface frac out of drilling fluid. Additionally, during the pilot drilling the HDD contractor will have a “spotter” walking the drill alignment as the HDD drills from the saltmarsh to the exit monitoring for any frac out. The spotter will quickly identify any frac out, drilling will stop, and the frac out will be contained and removed. Containment is typically achieved by placing sandbags around the fluid. Removal is typically by a small hand carried pump connected to layflat hoses that are extended to either the entry pit, exit pit, or a bowser at a suitable location nearby.
- During reaming of the bore, the fluids are contained within the cofferdam. The cofferdam will be at least 75 m from the saltmarsh (based on HDD exit pits located at 105 m from the saltmarsh and maximum length of the cofferdam of 30 m). There will be pumps and storage at the cofferdam to recover any fluid should any escape from the cofferdam. There will be personnel at the location who will be able to quickly identify any losses and take the necessary remediation action. If drilling fluid does escape from the cofferdam, the fluid is more dense than water and remains in situ on the seabed unless there are strong currents or wave action. This is also true for flocculated drilling fluid. The incoming tide at the location, even with a very strong easterly wind, is very unlikely to move drilling fluid more than 20 m from the loss location. Therefore, in the unlikely event that fluid is lost from the cofferdam and not removed, there is a very low risk of any fluid being washed 75 m inshore to the edge of the saltmarsh.
- Before removal of the cofferdam, the drilling fluid will be removed from within the cofferdam as far as practicable. Following removal of the cofferdam the duct end will be buried and a watch will be kept over the following week for any accumulations of drilling fluid, that will be removed using the same methods as used during pilot drilling.

# 3. Description of Seabed Preparation

## 3.1 Overview

3.1.1 Seabed surveys would be carried out prior to installation to reconfirm existing geotechnical and geophysical information about seabed conditions, bathymetry, ground conditions, and other seabed features.

3.1.2 Route preparation would involve clearance activities to ensure the installation corridor is clear of boulders, dropped object debris and other obstacles. Removal of out-of-service (OOS) cables would be required, along with boulder/debris clearance using either grapnels or Remotely Operated Vehicles and grabs.

## 3.2 Pre- Construction Surveys

3.2.1 Pre-installation surveys may involve a range of standard marine survey techniques including:

- Bathymetry: Multi-Beam and Single Beam Echo Sounders (MBES and SBES) to record water depth, prepare a three dimensional (3D) digital terrain model of the seabed, and to identify relevant bedforms/confirm areas of mobile sediments.
- Side Scan Sonar (SSS): Mapping of the seabed surface and identification of sediment types. Obstacles lying on the seabed, such as wrecks, debris, pUXO, and surface-laid or exposed pipelines and cables that might impede cable installation can be identified from the SSS outputs.
- Sub-Bottom Profiling (SBP): Directing a pulse of acoustic energy into the seabed and using reflections from the sub-surface geology to assess the thickness, stratification, and nature of the seabed sediments.
- Magnetometer/Gradiometer: Passively detect magnetic anomalies compared to the earth's magnetic field. Such anomalies can be caused by geological faults and buried metallic objects such as pUXO, pipelines, cables and archaeological features.
- Benthic Ecology: Drop Down Video or Remotely Operated Vehicle (ROV) mounted cameras may be used to confirm the locations and extents of sensitive benthic habitats or features. This would inform micro-routeing of submarine cable systems to avoid or minimise interactions with these features in so far as practicable.
- Geotechnical: Vibrocore and Cone Penetration Test (CPT) samples may be obtained to inform engineering method decisions, micro-routeing and installation tool selection at specific locations. This would verify whether ground conditions are suitable for cable trenching as well as to assess the existing Ground Model from the seabed sediments with regard to engineering of crossing structures and trenching equipment intended to be used.
- Visual inspection by ROV might be required of submarine assets to be crossed.

## 3.3 Seabed Preparation

## Boulder Clearance

3.3.1 Re-routing around boulders and archaeological finds is the Proposed Project's primary solution when installing the cable. If re-routing around boulders is not practicable, these features will be repositioned within the Order Limits in consultation with PLA prior to commencing pre-clearance activities and considering Areas of Safeguarded Water Depth.

3.3.2 At present, no expected boulder removal is anticipated to be required along the route. However, in the event that boulders are identified and considered as an impediment to the construction during the pre-installation survey, these would be removed by either a subsea grab or a displacement plough (although the latter is unlikely to be used by the Proposed Project) or a combination of both depending on site conditions. The grab is deployed from a stationary vessel, and it removes the boulders individually with the assistance of a ROV. The plough is towed by the vessel, and it displaces the boulders along the route as the vessel moves forward.

## Unexploded Ordnance (UXO) Clearance

3.3.3 A high-level desktop study risk assessment of UXO was undertaken in summer 2021 to inform the subsequent geophysical and geotechnical seabed survey undertaken in Autumn 2022. The UXO risk was assessed as High and Medium throughout the Offshore Scheme Order Limits. As part of the seabed survey, single source magnetic data was collected to provide an overview of the distribution of magnetic anomalies and to cross-check with the desk-based risk assessment, where areas of known high UXO densities have been identified though a magnetometer survey in 2023.

3.3.4 Geophysical surveys are scheduled for April, May, and June 2026 for UXO target identification. The primary purpose of these surveys is to locate and record the positions of potential UXO objects, enabling National Grid to refine its route planning and ensure safe installation operations. Micro-routeing around isolated targets would be undertaken, with a closest point of approach to the target, based on the eventual installation methodology.

3.3.5 Whilst avoidance would be the preferred approach, if UXO clearance is necessary, the activity would be undertaken in accordance with approved industry practices for removal and disposal/waste management of ordnance. This may include detonating UXO in place or lifting and relocating to a designated storage or demolition area, for safe disposal.

3.3.6 A separate Marine License application will be applied for any UXO clearance activities following the latest 2025 guidance[1].

## Pre-Sweeping

3.3.7 Pre-sweeping would be required if areas of large sand waves are identified within the Offshore Scheme which cannot be avoided, or in areas where additional lowering is required to achieve safeguarded water depth. Pre-sweeping may be performed using a variety of tools including dredgers, mass flow excavation (MFE) or controlled flow excavators (CFEs).

[1] https://www.gov.uk/government/publications/supporting-minimising-environmental-impacts-from-unexploded-ordnance-clearance/supporting-minimising-environmental-impacts-from-unexploded-ordnance-clearance

3.3.8 The amplitude of mobile bedforms need to be reduced to ease cable installation and to achieve an ideal burial depth (installation in the non-mobile section) for the lifetime of the system. The common practice involves the removal of sediments by Trailing Suction Hopper Dredging or MFE. The Trailing Suction Hopper system involves lowering a dredging arm to the seabed with high pressure water pumps flushing water into the seabed and the resulting loosened sediments are suctioned up into the hopper of the vessel and later disposed of. In the MFE technique, high volume of water is produced and directed downwards onto the seabed thus loosening and dispersing the mobile sediments.

3.3.9 As per the dML Part 2, Condition **1**, Design parameters the total pre-sweeping volume must not exceed 325,000 cubic metres. The areas of pre-sweeping which have been identified are as follows:

- KP 38.7 to KP 44.4.
- KP96.32 to 113.883.

3.3.10 The final CSIP will describe the approach, timing and scale of pre-sweeping activities.

## Pre-Lay Grapnel Run

3.3.11 A pre-lay grapnel run (PLGR) is also expected to be completed, involving towing a heavy grapnel with a series of specially designed hooks along the centre line of the route, to confirm the installation route is clear of obstacles. Cable route clearance using the methods described here would seek to avoid areas of known sensitive habitats and/or features and would not be used near in-service third-party assets. PLGR operations are typically only 1-3 m wide.

3.3.12 The final CSIP will set out the PLGR corridor and programme of works.

## Archaeology

3.3.13 Any archaeology finds found either outside or within the three Areas of Safeguarded Depth would not be relocated within the three Areas of Safeguarded Depth.

# 4. Description of Cable Lay and Burial

## 4.1 Overview

4.1.1 Cable installation operations would be performed on a 24 hour basis in order to minimise installation time and therefore the duration of any disruption to sensitive environmental receptors, as well as navigation and other sea users. 24 hour operations would also maximise available weather opportunities, as well as vessel and equipment availability. 24 hour installation also reduces the risk to the cable itself during installation, to prevent undue tension on the cable and cable handling accidents.

4.1.2 Cable installation vessels will operate in areas where water depth is sufficient for the cable lay and other vessels.

## 4.2 Cable Lay

4.2.1 The following cable laying methodologies may be used:

- Simultaneous cable lay and trenching/burial (SLB); and
- Surface cable lay followed by post lay trenching of cables/burial (PLB).

4.2.2 SLB is becoming more widespread as installation contractors design and build their own ploughs. It has the advantage of providing immediate protection to the cable but requires the cable lay vessel (CLV) to be longer on site due to the slower speed compared to surface laying. This may become an issue in areas where weather patterns are unpredictable. It does however reduce the overall duration of lay and protection works. SLB is not being encouraged for the Proposed Project due to the nature of the seabed conditions found along the route.

4.2.3 PLB separates the lay and protection activities, enabling the CLV to lay quickly and then move onto other operations whilst a separate spread undertakes the burial activities. This also has advantages in that a wider range of burial tools may be considered, depending on the nature of the seabed.

4.2.4 The location of planned wet storage areas if required will also not occur within three Areas of Safeguarded Depth, as defined by the Port of London Authority as being the “Sunk Pilot Boarding area”, “Long Sand Head Two-Way Route crossing area” and “Northeast Spit area” (**Application Document 9.104 Areas of Safeguarded Water Depth Plan**).

4.2.5 The final CSIP will set out the method of cable installation including information on the equipment, timing and programme of these works.

## 4.3 Cable Burial

4.3.1 The cables will be buried below the seabed wherever possible, with a target burial depth informed by the Cable Burial Risk Assessment (CBRA) that will support the final CSIP.

4.3.2 The standard post lowering and burial methods are listed below, followed by an outline description. The choice of burial tool would be informed by the findings of the pre-installation surveys and micro-routeing requirements and would be assessed to confirm suitability for the expected seabed sediment conditions prior to award of the installation contract. There are four generic types of equipment for trenching the cables:

- Cable burial ploughs;
- Jet trenching (towed, free swimming or tracked);
- Mechanical trenchers (tracked); and
- Mass (or controlled) flow excavators (MFE).

## Cable Burial Ploughs

4.3.3 Ploughs are large machines towed behind a vessel that create a trench into which the cable is laid. This trench is then normally left to backfill naturally but can sometimes be backfilled manually. Ploughs may be used for simultaneous lay and burial or for pre-lay trenching. Ploughs are best suited for relatively soft sediments.  There are two types of cable ploughs: displacement ploughs (creating an open trench for the cable) and non-displacement ploughs (lowering the cable into the sediment). Non-displacement ploughs are towed either by the CLV or an auxiliary vessel following the CLV.

## Jet Trenching

4.3.4 Jet trenchers use high pressure water jets to fluidise the seabed and bury the cable, they are most effective in soft sediments, non-cohesive and normally consolidated sediments.  Jet trenchers may be self-propelled ROVs or they may be towed sledges. Both use water jets to fluidise the seabed in front of, and around the cable, so that the cable sinks into the sediment under its own weight. In medium to coarse sands and in gravels, the reconsolidation of fluidised sediments is significantly faster than in fine sands and silts. Jet trenching is a viable technique in a wide range of sediments, although performance decreases with:

- Increases in sediment shear strength. cohesiveness (e.g., contents of clay) and consolidation;
- Increases in organic content (peat); and
- Increases in particle size (e.g., gravels, cobbles).

4.3.5 Systems can achieve burial in excess of 3 m in soft clays and fine sands, while in medium to coarse sands, the burial depth achieved depends on the grain size of the sediment (i.e., on the re-sedimentation velocity). Any trench remaining after re-sedimentation is left to backfill naturally as a result of the natural movement of sediment on the seabed.

## Mechanical Trenching

4.3.6 Mechanical trenchers are usually mounted on tracked vehicles and use chains or toothed wheels to cut a trench. They are effective in a range of sediments, including weathered softer bedrock and very soft sediment. However, they are less effective in certain types of rock (e.g., chalk with flints), large gravel, glacial till or boulder clays. The mechanical trencher follows the cables that have been pre-laid on the seabed, collects them, keeping them clear of active trenching, before guiding the cables into the trench and backfilling sediment on top of the cable. The backfill material and suspended sediment stays in the direct area of the mechanical trencher and the backfilled trench. In some instances, they may be used to create a pre-lay trench into which the cable is laid.

### Mass Flow Excavators (MFE)

4.3.7 MFE may be used for the excavation of the HDD exit pits, sand wave lowering, plough backfill and burial of joints, as well as to increase the depth of lowing (DOL), in sections with medium to coarse sands, where achieved trenching depths using other methods may not meet the minimum depth of lowering. MFE uses low-pressure water to fluidise the seabed around the cable, allowing the cable to sink into the sediment under its own weight. In medium to coarse sand, MFE creates a depression with fluidised sediment as it moves over the cable. The majority of the fluidised sediment re-settles to the rear of the operation, thus backfilling the trench and covering cable. In fine sand and silt, MFE leaves behind an open trench with very little cover on the cable. Turbidity within the water column as a result of MFE in medium to coarse sand is comparable to that of jet trenching. Suspended sediment stays in the direct area of the operations and either re-settles into the created depression or in its direct vicinity. The seabed footprint of MFE may create a depression up to 10 m wide.

### Backhoe Dredging

4.3.8 The use of a back-hoe dredger may be required to support with pre-installation trenching. A back-hoe dredger is essentially a bucket digger operated from a shallow water barge. It may be self-propelled for positioning on site, or non-self-propelled and relying on the help of workboats. It will maintain position by deployment of spud legs to excavate the shallow water sediment to provide a trench for the cable to be installed in.

### Cable Burial Risk Assessment (CBRA)

4.3.9 The assessment in the CBRA considers potential risks and impacts to the cables themselves. These alongside impacts on other receptors such as shipping, marine archaeology and benthic ecology will all contribute to the final cable design set out in the CSIP.

4.3.10 The minimum depth of lowering (DOL) to the top of the cable is 0.5 m (in areas of bedrock), with a target DOL for the Proposed Project approximately 1 m–2.5 m, to be achieved where possible dependent on the seabed geology.

4.3.11 Existing infrastructure ‘As built’ documents of the export cables shall be provided to the Port of London Authority, London Gateway Port Limited, and Harwich Haven Authority for their records of the depths and locations of cables. Any updates to these documents caused by items such as cable repairs etc. shall be co-ordinated with these authorities.

## 4.4 Cable Jointing

4.4.1 Offshore cables would be installed in sections (with joints between the sections as required). It is, however, possible, given the length of the cable, that no field joints would be required during construction, but this would depend on the contractor, capacity of the lay vessels, lay vessel availability.

4.4.2 Field joints may be either ‘in-line’ or ‘omega’ (hairpin) types. In-line is used where a second length of cable is joined to the first and lay continues in the same direction. An omega type joint is where the two sections of cable have been laid in opposite directions and require a joint. A cable repair requires two joints and typically has one of each. A field joint casing is usually designed to go through the PLB systems, but not with SLB systems. However, the configuration of an omega joint with tight bends may allow some access for PLB systems. In areas not accessible to PLB systems, either controlled flow excavation or rock protection such as mattresses and rock bags (or a combination of both) is used to complete the protection.

4.4.3 A single joint takes in the order of 5–7 days to complete (excluding any seabed preparation and post-jointing lowering and protection). Where the cable is bundled, and depending upon the facilities on the CLV, then simultaneous operations may take place, meaning both cables can be done in a similar time. The time to protect the inline joint by trenching or jetting would be in the order of 8–12 hours. An omega joint would require a larger seabed area than an inline joint as more cable is required – at least 2 x water depth plus the deck length of the vessel. Sea Link is anticipated to have one omega joint outwith the SUNK, allowing two cable lay campaigns although this would depend on the selection of the CLV as new vessels are coming into the market capable of carrying the full length in one load.

4.4.4 There are no planned cable joints within the three Areas of Safeguarded Depth presented within Plate 1.2, excluding the need for any unforeseen repairs during installation and/or the operational lifetime.

4.4.5 If unforeseen repairs during installation and/or the operational lifetime occur within the three Areas of Safeguarded Water Depth, the Applicant would consult with the relevant Port Authorities.

# 5. Cable Protection

## 5.1 External Cable Protection

5.1.1 The primary mechanism to infill the cable trench and allow the seabed to revert to natural bedforms along the route is by natural backfill which utilises the processes sediment circulation and deposition.

5.1.2 In sections of the route identified as having the highest risk of cable strike due to marine traffic, a TDOL between 2.0 m to 2.5 m is proposed. The trench along these sections – specifically KP 38 to KP 58, and KP 81.5 to KP 96.5 – is proposed to be backfilled using rock to a level 20% below the original seabed level. The remaining trench depth will be allowed to naturally backfill (Plate 5.1).

### Types of External Cable Protection

5.1.3 External rock protection needs to provide a strong protective cover to protect the cables from external threats, such as potential interactions with other marine activities including anchoring and fishing and ensures stability of the cables, by shielding the cable from the currents. When considering external cable protection, the safety of other sea users must also factor into the design and materials used.

5.1.4 The types of external cable protection for offshore cable projects include:

- Rock backfill
  - The Proposed Project has identified 'high risk' areas for anchor strike along the offshore route (KP 38 to KP58, and KP 81.5 to KP 96.5). At this location, rock will be used to 'backfill the cable trench to 20% below the original seabed level (not overtopping) to provide additional protection from anchor strikes and other shipping activities.
- Rock placement
  - Rocks of different grades or sizes are placed over the cable, typically, smaller rocks are placed over the cable as a covering layer, topped with an armouring layer of larger rocks. Rock protection generally forms a trapezium shape over the cable, with a slope either side, designed to provide protection from both direct anchor strikes and anchor dragging.
- Concrete mattresses
  - Concrete mattresses are formed by interweaving a number of small concrete blocks with rope and wire to provide a flexible protective mattress. They are lowered to the seabed on a frame and, once positioning is confirmed, released over the length of cable requiring protection. Mattresses provide protection from direct anchor strikes but rock protection provides better protection from anchor drag.
- Rock bags

— Rock bags consist of various sized rocks constrained within a wire or rope net. Rock bags are more suited for addressing cable trench stability and scour related issues. Typically used in more localised protection than rock placement.

5.1.5 The Applicant will ensure that the contractor considers measures to avoid use of microplastics where possible.

5.1.6 The Applicant will factor in the removability of cable protection for the Proposed Project dependent on its use and available best practice guidance for cable decommissioning.

## Remediation

5.1.7 For areas of insufficient backfill, the Proposed Project would take the decision to either re-survey or instruct remedial works. Indicative contingency for remedial rock protection is 15% of non-high-risk length (excluding trenchless solutions at landfall) with an estimated Length of 12,000m. Such remedial works may include:

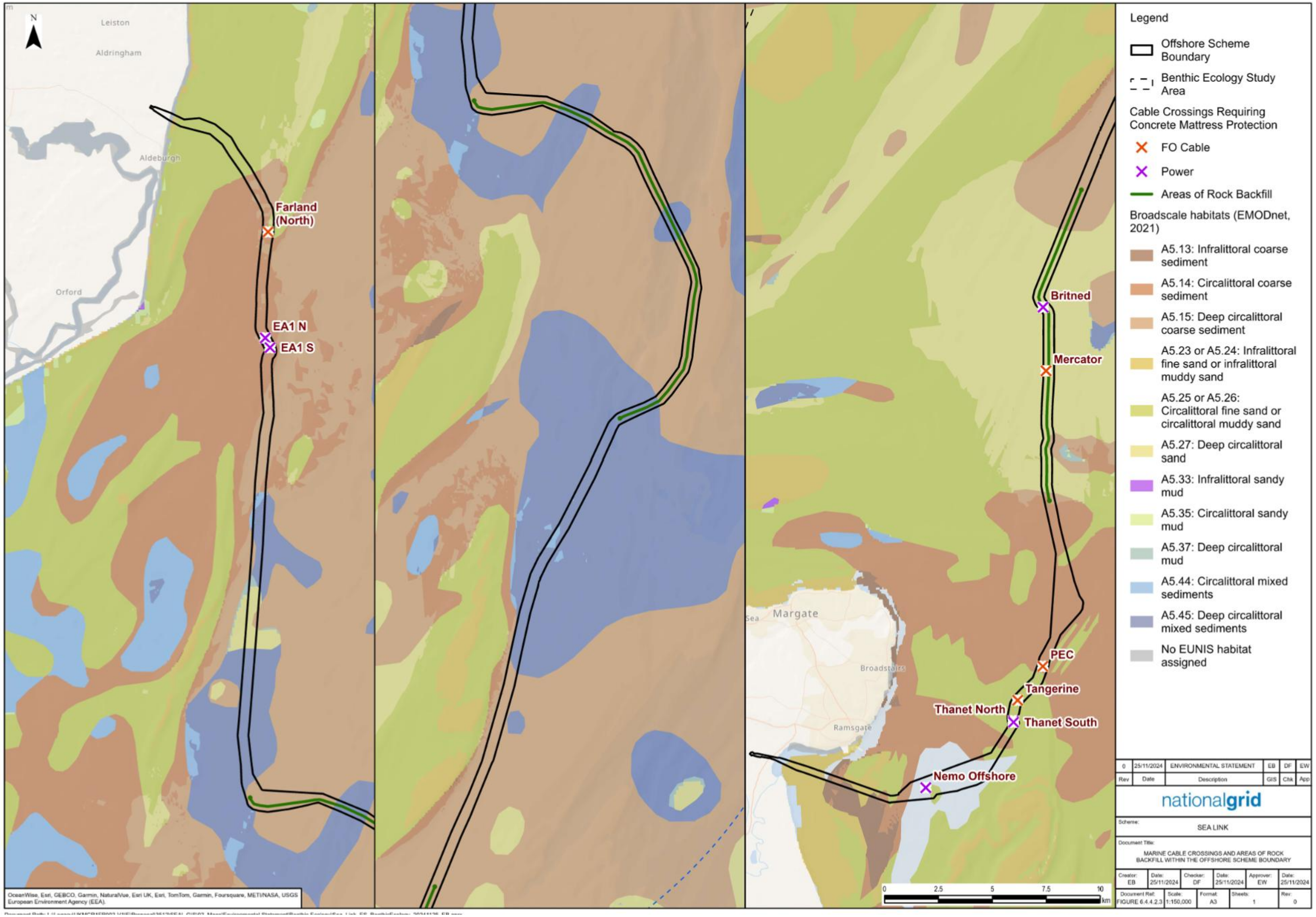
- rock placement; and
- controlled Flow Excavation (CFE), to collapse the trench walls to achieve backfill.

5.1.8 It should be stressed that cable burial is the primary method of cable protection, and additional external cable protection will only be used as a contingency where cable burial is not appropriate or achievable during installation, or through the unlikely exposure or repair of the cable during operation. External cable protection will only be used where efforts for burial have been exhausted.

5.1.9 Typical remedial rock dimensions are:

- **Berm:** 1.0 m (H) x 1.0 m (top) 7.0 m (base) with 1:3 slope.
- **Rock Bags:** 0.6 m (H) x 4 m (W) x 4 m (L).

5.1.10 The final CSIP, taking into account the results of the CBRA and consideration of the potential environmental impacts set out in **Application Document 6.2.1.4 Part 1 Introduction Chapter 4 Description of the Proposed Project [REP1A-003],** will set out the need for and method of any cable protection required.




## Plate 5.1 Offshore scheme cable crossings and areas of rock backfill

## 5.2 Cable Crossings

5.2.1 It is necessary to cross existing cables along the route corridor to achieve connection from Suffolk to Kent landfalls.

5.2.2 Cable crossings are subject to crossing agreements post-consent with the owners of those existing assets, and are necessary to provide protection to both assets, and to ensure a minimum separation so that cables do not overheat. Cable crossings may utilise rock protection or concrete mattresses (or both).

5.2.3 There are ten marine in-service power and fibre optic crossings as summarised in Table 5.1. The table also contains the onshore crossing locations for Nemo Link and Thanet which would be crossed by passing under the existing asset via trenchless solution such as HDD along with other onshore utilities.

### Table 5.1 Summary of in-service crossings

| KP | Name | Owner | Type | Status |
|---|---|---|---|---|
| 8.365 | Farland (North) | BT | FO Cable | In service |
| 13.373 | EA1_N | Scottish Power Renewables | Power | In service |
| 13.769 | EA1_S | Scottish Power Renewables | Power | In service |
| 87.306 | Britned | BritNed | Power | In service |
| 90.74 | Mercator | BT | FO Cable | In service |
| 104.591 | PEC | Lumen | FO Cable | In service |
| 106.747 | Tangerine | Lumen | FO Cable | In service |
| 107.594 | Thanet_N | Balfour Beatty | Power | In service - offshore (northern cable) |
| 107.647 | Thanet_S | Balfour Beatty | Power | In service- offshore (southern cable) |
| 113.106 | Nemo_Off | Nemo Link | Power | In service – offshore |
| 120.86 | Nemo_Onshore_1 | Nemo Link | Power | In service – onshore cable #1 |
| 120.861 | Nemo_Onshore_2 | Nemo Link | Power | In service – onshore cable#2 |
| 120.885 | Thanet Onshore | Balfour Beatty | Power | In service - onshore |

5.2.4 In addition to the above in-service power and fibre optic cables,Table 5.2 below also lists the nine known developments also likely to cross the Offshore Scheme but at this stage, specific locations are unknown. Note that the two planned interconnectors indicated at the foot of the table have been notified by OFGEM, but the proposed corridors are unknown but given the landing points these links would cross the Sea Link route.

### Table 5.2 Summary of future known developments

| KP | Name | Owner | Type | Status |
|---|---|---|---|---|
| 11.354 | EA3_N_Corr | Scottish Power Renewables | Power | Planned Corridor (northern limit) |
| 14.482 | EA3_S_Corr | Scottish Power Renewables | Power | Planned Corridor (southern limit) |
| 50.181 | FiveEstuaries_N_Corr | RWE | Power | Planned Corridor (northern limit) |
| 50.672 | NeuConnectRPLRev6 | Neuconnect | Power | Planned Route |
| 52.012 | NorthFalls_N_Corr | SSE/RWE | Power | Planned Corridor (northern limit) |
| 52.719 | FiveEstuaries_S_Corr | RWE | Power | Planned Corridor (southern limit) |
| 53.032 | NorthFalls_S_Corr | SSE/RWE | Power | Planned Corridor (southern limit) |
| 88.646 | Nautilus_Opt1 | NGV | Power | Planned |
| 100.151 | Q&E North | Consortium | FO Cable | To be installed 2024/2025 |
| 101.27 | Grid Link | Icon | Power | Planned |
| Unknown | Cronos Interconnector | Cronos Energy Ltd | Power | Early phase |
| Unknown | Tarchon Interconnector | Tarchon Energy Ltd | Power | Early phase |

5.2.5 The Proposed Project would enter into crossing agreements and/or proximity agreements with the third-party asset owners of any subsea infrastructure installed and/or planned along the corridor. Power, telecom and fibre optic cables would be crossed by the HVDC cables; these cables would be both In-Service (IS) and out of service (OOS).

5.2.6 Crossings of IS cables would be undertaken using agreed crossing designs in accordance with the crossing agreements with the third-party owners and would ensure separation between the assets and protection over the installed HVDC cables. The separation and protection structures may comprise concrete mattresses, protective sleeves on the HVDC cables and/or pre- and post-lay rock placement. OOS cables may be cleared prior to installation of the cables, thus removing the need for a crossing structure.

5.2.7 Typical crossing dimensions are as follows:

- **Berm:** 1.0 m (H) x 1.0 m (top) 10.0 m (base) with 1:3 slope.
- **Mattresses:** 0.45 m (H) x 3.0 m (W) x 6.0 m (L).

5.2.8 The proposed crossing locations within the three Areas of Safeguarded Depth, including in areas of stiff clay or chalk, provide sufficient water depth to safeguard under keel clearance referred to within Section 1.4. The exception is the currently proposed Gridlink crossing location, where the agreed mitigation with the asset owner is to cross further east in deeper water within the order limits. The Proposed Project will enter into crossing agreement with Gridlink.

5.2.9 Details of all cable crossing designs and the proposed installation method of the Proposed Project will be set out in the final CSIP.

5.2.10 It is likely that Sea Link will be crossed by third party infrastructure during its operational life. However this is outside the remit of the CSIP.

# 6. Maintenance

6.1.1 The cable system installation is designed such that a regular maintenance regime is not required to maintain the integrity of the link. However, the monitoring surveys and the land based DTAS (Digital Temperature and Acoustic Sensing) monitoring may indicate that localised lengths along the cable link may require maintenance. This would normally be in areas of mobile sediment, such as scour or mobile bedforms migrating over the route, which alters the DOL of the cable. Maintenance may be the addition of mattresses, rock or grout bags, installation of remedial rock berms, additional trenching (where appropriate), or the removal of excess sand depth, as mobile bedforms migrate, resulting in excessive depth of lowering (DOL). The latter would be undertaken using a Controlled Flow Excavator, or partial deburial methods (eductor).

6.1.2 Cable repairs may be required at any time, however good design and installation would mitigate this. A repair preparedness plan (RPP) would be prepared which details the actions to be taken, from detecting a fault to re-commissioning the project.

6.1.3 Repairs which occur after commissioning and acceptance of a successful installation and protection project are rare and can usually be attributed to the following:

- Cable technical failure;
- Marine traffic accidental damage such as an anchor strike or fishing gear snagging or entanglement; and
- Third party works.

6.1.4 The marine cable repair requirements for Sea Link are split into three components (Nearshore Pegwell Bay, Offshore and Suffolk) due to the complexity of the Pegwell Bay nearshore area, comprising mudflats which are exposed for significant parts of the tidal cycle and therefore the complexity of access to any repair site, and the use of trenchless solutions to cross the beach landings.

6.1.5 Prior to any repair scenario, the location of the fault needs to be identified and confirmed from TDR (time domain reflectometry), and OTDR (Optical time domain reflectometry) where the fibre optic cable may be damaged and visual survey of the seabed (where external damage is thought to be the cause of the fault) which may lead to a delay prior to commencing the cable deburial and repair activities.

6.1.6 A spare conduit would be installed at both landfalls (which can accommodate an HVDC or fibre optic cable), so that if there is a cable issue which is deemed to be a high-risk repair, the simplest solution would be to install a new section of cable from offshore to the Transition Joint Bay (TJB) and cut and splice to the existing cable offshore. An onshore joint would then be carried out at the TJB allowing a relatively rapid repair window.

# 7. Post-Installation Monitoring

7.1.1 During operation the HVDC link would transmit electricity from the proposed Friston Substation to the existing network in Kent and vice versa depending on the supply and demand at the time. During the lifetime of the link, scheduled monitoring of the system would be undertaken via:

- Electrical testing and monitoring of system.
- Depth of Lowering assessment by planned surveys comprising General Visual Inspection (GVI), bathymetric survey (MBES) and buried cable detection (cable tracker) to chart the cable depth of lowering over time.
- Surveys of crossings with 3rd Party subsea assets, as per requirements in separate crossing agreements per asset.
- Surveys of new asset crossings / proximity zones when new structures are installed crossing over the Sea Link route.
- DTAS (Digital Temperature and Acoustic Sensing) HVDC status monitoring via fibre optic cable (innovative in-situ monitoring of cable via near real-time temperature and acoustic monitoring which can inform of changes to the cable by intrusive contact as well as variations in depth of burial dependant on thermal changes on the baseline conditions).

7.1.2 A preliminary inspection, maintenance and repair (IMR) programme as the basis for preventative maintenance may comprise of the following:

- Base-line as-built depth of lowering (DOL) survey (ideally a continuous survey after installation and protection completed).
- Initial DOL monitoring survey 12 months after commissioning and handover to operations.
- Regular monitoring surveys at approximately 12-24 months duration to establish any areas where DOL hot spots may develop and where integrity of cable is critical and inform the maintenance programme. Establish that the seabed conditions and DOL have reverted to equilibrium and reduce the frequency of inspections.
- Reduced interval surveys to ensure DOL is maintained (may be as much as 5-year interval).
- Potential DTAS HVDC cable monitoring via fibre optic cable with near real-time monitoring. As changes occur through time, these can be used as locators of potential seabed change resulting in heat changes, or areas where increase in vessel traffic through the lifetime of the asset may make the link more vulnerable to damage than was risked during the original design of the cable route. The DTAS HVDC cable monitoring would be carried out from the onshore converter stations, but the results would be used to inform the IMR programme each year, and the repair locations in the event of an outage or significant disruption to the transmission of power along the link.
- AIS vessel monitoring to track any vessels stationery or acting suspiciously in the vicinity of the cable.

# 8. Sediment Disposal Management

## 8.1 Overview

8.1.1 During the construction of the Proposed Project, there will be a release of material caused by certain construction activities. Some of these activities will release seabed material into the water column at source, some will need to move it and release it in a different location. This disposal activity will involve the deposit of inert, native sedimentary material originating from the following activities associated with the construction of the Proposed Project:

- Cable installation preparation; and
- Excavation of horizontal directional drilling (HDD) exit pits.

8.1.2 Under the deemed Marine Licence, draft Development Consent Order (dDCO) Schedule 16, the Proposed Project seeks consent for the disposal of these materials.

8.1.3 Any material cleared or produced during seabed preparation or through the excavation of HDD exit pits will be deposited within the Order Limits seaward of Mean High Water Springs (MHWS).

## 8.2 Sediment Disposal Constraints

### Avoidance of Disposal within the Areas of Safeguarded Depth

8.2.1 There is a concern from navigation stakeholders that dredge and cleared material as a result of construction activities would be deposited within the Areas of Safeguarded Water Depth outlined in Section 1.4.

8.2.2 The concern specifically relates to there being a reduction in navigable depth should material be disposed of within these three key areas of interest.

8.2.3 In response to this concern, the Proposed Project proposes that any material that is extracted from the seabed during planned construction activities will not be disposed of within the three Areas of Safeguarded Water Depth as identified within Plate 1.2 and **Application Document 9.104**.

## 8.3 Environmental Principles

### Avoidance of Disposal in Proximity to Sensitive Benthic Habitats

8.3.1 Sediment disposal will comply with **Application Document 7.5.2 Outline Offshore Construction Environmental Management Plan [APP-339].**

### Archaeological Exclusion Zones

8.3.2 Sediment disposal will comply with **Application Document 7.5.5 Outline Offshore Written Scheme of Investigation [PDA-033].**

# 9. Pollution and Waste Management

## 9.1 Pollution Prevention

9.1.1 A Marine Pollution Contingency Plan (MPCP) as secured within Condition 4(1)((viii) of the dML will be developed post-consent prior to construction of the Proposed Project. This plan will set out the measures to be in place to minimise the risks of pollution incidents as well as the procedures to be followed if a pollution incident does occur. These include key measures listed in Table 9.1 below.

9.1.2 The MPCP will also include the key roles and their responsibilities and relevant contact details.

### Table 9.1 Pollution Prevention Measures and Commitments

| Commitment | REAC Number |
| --- | --- |
| All project vessels shall adhere to the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (BWM Convention). | LVS01 |
| All project vessels must comply with the International Regulations for Preventing Collisions at Sea (1972) (IMO, 2019), regulations relating to International Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73/78) (IMO, 2019) with the aim of preventing and minimising pollution from ships and the international Convention for the Safety of Life at Sea (SOLAS, 1974). | LVS02 |
| An installation machine failure contingency plan will be produced prior to installation. | LVS03 |
| All oil, fuel and chemical spills will be reported to the MMO Marine Pollution response team. | LVS04 |
| Drilling fluids required for trenchless operations will be carefully managed to minimise the risk of breakouts into the marine environment. Specific avoidance measures would include:<br>• the use of biodegradable drilling fluids (pose little or no risk (PLONOR) substances) where practicable;<br>• drilling fluids will be tested for contamination to determine possible reuse or disposal; and<br>• If disposal is required drilling fluids would be transported by a licensed courier to a licensed waste disposal site. Any leakage of fluids during break-out will be dispersed by local currents and broken down in the seawater. | LVS05 |

## 9.2 Waste Management

9.2.1 A Waste Management Plan as secured within Condition 4(1)((ix) of the dML will be developed post-consent prior to construction. All waste will be managed by the relevant contractor and requirements in accordance with the Waste Hierarchy (a tool that prioritises how to manage waste in order of preference) implemented:

- Prevention.
- Minimisation.
- Reuse.
- Recycle.
- Energy recovery.
- Disposal.

9.2.2 During the works any waste generated will be dealt with in a lawful manner. At sea, no waste will be disposed of over the side of any vessel and all produced waste will be segregated and stored on board. All waste products and rubbish will be removed from the vessel and disposed of by a registered waste disposal company. Details of waste handling and anticipated types and volumes will be provided in individual method statements.

9.2.3 Best practice measures will be followed and any waste materials arising during the works will be removed for disposal at approved locations above the tidal level of MHWS (**Application Document 7.5.3 Onshore Construction Environmental Management Plan**).

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

Registered in England and Wales
No. 4031152
nationalgrid.com