Eastern Green Link 4

Marine Environmental Appraisal Non-Statutory Scoping Report

Prepared for: National Grid Electricity Transmission (NGET) and Scottish Power Energy Networks (SPEN)

collaborative environmental advisers

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Abbreviations/Glossary

AA	Appropriate Assessment	ABP	Associated British Ports
AC	Alternating Current	AEZ	Archaeological Exclusion Zone
AIS	Automatic Identification System	ALARP	As Low As Reasonably Practicable
AONB	Area of Outstanding Natural Beauty	ASTI	Accelerated Strategic Transmission Investment
ATT	Admiralty Total Tide	BAP	Biodiversity Action Plan
BEIS	Department of Business, Energy and Industrial Strategy	BGS	British Geological Society
BP	(years) Before Present	BMAPA	British Marine Aggregate Producers Association
BRIG	Biodiversity Reporting and Information Group	BTO	British Trust for Ornithology
CBRA	Cable Burial Risk Assessment	CCS	Carbon Capture Storage
Cefas	Centre for Environment, Fisheries and Aquaculture Science	CEMP	Construction Environmental Management Plan
CFSR	Climate System Forecast Reanalysis	CIfA	Chartered Institute for Archaeologists
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora	CLB	Cable Lay Barge
CLV	Cable Lay Vessel	CODA	Cetaceans Offshore Distribution and Abundance in the European Atlantic
COHSR	Conservation of Habitats and Species Regulations	COLREGs	International Regulations for Preventing Collisions at Sea
COMHSR	Conservation of Offshore Marine Habitats and Species Regulations	CSV	Construction Support Vessel
DBA	Desk-Based Assessment	DC	Direct Current
DECC	Department of Energy & Climate Change	DEFRA	Department for Environment, Food and Rural Affairs
DOME	Database on the Marine Environment	DP	Dynamic Positioning
DTM	Digital Terrain Model	DWT	Deadweight Tonnage
EDRs	Effective Deterrence Ranges	EEA	European Economic Area
EEZ	Exclusive Economic Zone	EGL	Eastern Green Link
EIA	Environmental Impact Assessment	EIFCA	Eastern Inshore Fisheries and Conservation Authority
EMF	Electromagnetic Field	EMODnet	European Marine Observation and Data Network
EMS	European Marine Site	ES	Environmental Statement
ESCA	European Subsea Cables Association	EU	European Union
EUNIS	European Nature Information System	FCS	Favourable Conservation Status
FLMAP	Fisheries Liaison and Mitigation Action Plan	FLO	Fisheries Liaison Officer
FLOWW	Fishing Liaison with Offshore Wind and Wet Renewables Group	FOCI	Features of Conservation Interest
GB	Great Britain	GES	Good Environmental Status
GIS	Geographical Information System	GW	Gigawatt

HAT	Highest Astronomical Tide	HDD	Horizontal Direction Drilling
HE	Historic England	HER	Historic Environment Record
HES	Historic Environment Scotland	hp	Horsepower
HPMA	Highly Protected Marine Area	HRA	Habitats Regulations Assessment
HSC	Historic Seascape Characterisation	HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current	IAMMWG	Inter-Agency Marine Mammal Working Group
ICES	International Council for the Exploration of the Sea	IDP	Initial Decommissioning Plan
IFCA	Inshore Fisheries and Conservation Authority	IHLS	International Herring Larvae Surveys
IMO	International Maritime Organisation	INTOG	Innovation and Targeted Oil & Gas
IROPI	Imperative Reasons of Overriding Public Interest	IUCN	The International Convention for the Conservation of Nature
JNCC	Joint Nature Conservation Committee	KIS-ORCA	The Kingfisher Information Service – Offshore Renewable & Cable Awareness project
Km	Kilometre	km^2	Kilometre squared
KP	Kilometre Points	kW	Kilowatts
LAT	Lowest Astronomical Tide	LOC	Location
LSE	Likely Significant Effects	m	Metre
MAIB	Marine Accident Investigation Branch	MBES	Multibeam Echosounder Sounder
MCA	Maritime and Coastguard Agency	MCAA	Marine Coastal Access Act
MCZ	Marine Conservation Zone	MD-LOT	Marine Directorate - Licensing Operations Team
MEA	Marine Environmental Assessment	MEAp	Voluntary Non-Statutory Marine Environmental Appraisal
MFE	Mass Flow Excavator	MGN	Marine Guidance Note
MHWS	Mean High Water Springs	MINNS	Marine Invasive Non-Native Species
MLA	Marine Licence Application	MLWS	Mean Low Water Springs
mm	Millimetre	MMO	Marine Management Organisation
MoD	Ministry of Defence	MPA	Marine Protected Area
MPS	Marine Policy Statement	MSFD	Marine Strategy Framework Directive
MSL	Mean Sea Level	MW	Megawatt
MU	Management Units	NBN	National Biodiversity Network
MWR	Marine Works Regulations	NE	Natural England
NCMPA	Nature Conservation Marine Protected Area	NERC	Natural Environment and Rural Communities
NEIFCA	North Eastern Inshore Fisheries and Conservation Authority	NEWS	Non-Estuarine Waterbird Surveys
NETS	National Electricity Transmission System	NGET	National Grid Electricity Transmission
NFFO	National Federation of Fishermen's Organisation	NMP	National Marine Plan
NM	Nautical Mile	NNR	National Nature Reserve
NMPI	National Marine Plan Interactive Tool	NPPF	National Planning Policy Framework

NRA	Navigational Risk Assessment	NSA	National Scenic Area
NSTA	North Sea Transition Authority	NVC	National Vegetation Classification
O&M	Operation and Maintenance	OESEA	Offshore Energy Strategic Environmental Assessment
OCT	Open Cut Trench	OHL	Over-head Line
OEUK	Offshore Energies UK	OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OOS	Out of Service	OWF	Offshore Wind Farm
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic	PAH	Polycyclic Aromatic Hydrocarbons
PAD	Protocol for Archaeological Discoveries	PEXA	Practice and Exercise Areas
PCB	Polychlorinated Biphenyls	PMF	Priority Marine Feature
PLGR	Pre-Lay Grapnel Run	pSPAs	Proposed Special Protection Area
PMRA 1986	Protection of Military Remains Act 1986	RIAA	Report to Inform Appropriate Assessment
PWA	Protection of Wrecks Act	RIFGs	Regional Inshore Fisheries Groups
RIB	Rigid Inflatable Boat	ROV	Remotely Operated Vehicle
RNLI	Royal National Lifeboat Institution	RSPB	Royal Society for the Protection of Birds
RSMP	Regional Seabed Monitoring Programme	cSAC	Candidate Special Area of Conservation
RYA	Royal Yachting Association	SBL	Scottish Biodiversity List
SAC	Special Area of Conservation	SCANS	Small Cetacean Abundance in the European Atlantic and North Seas
SBP	Sub-bottom Profiler	SEA	Strategic Environmental Assessment
SCOS	Special Committee on Seals	SFF	Scottish Fishermen's Federation
SEPA	Scottish Environment Protection Agency	SMP	Shore Management Plan
SLB	Simultaneous Lay and Burial	SNCBs	Statutory Nature Conservation Bodies
SMRU	Sea Mammal Research Unit	SOPEP	Shipboard Oil Pollution Emergency Plan
SNH	Scottish Natural Heritage	SPEN	Scottish Power Energy Networks
SPA	Special Protection Area	SSS	Side Scan Sonar
SSC	Suspended Sediment Concentration	TAC	Total Allowable Catch
SSSI	Site of Special Scientific Interest	TCE	The Crown Estate
TAEZ	Temporary Archaeological Exclusion Zone	TO	Transmission Operator
TJB	Transition Joint Bay	UK	United Kingdom
TraC	Transitional and Coastal Waters Fish Monitoring Programme	UKHO	United Kingdom Hydrographic Office
UKCP	UK Climate Change Projections	VMS	Vessel Monitoring System
UXO	Unexploded Ordnance	VP	Vantage Point
WFD	Water Framework Directive	WebS	Wetland Bird Survey
WMS	Web Mapping Service	WHS	World Heritage Site

1. Introduction

1.1. Background

The Eastern Green Link 4 (EGL 4) (here-in after referred to as the 'Project') is being developed by National Grid Electricity Transmission (NGET) and Scottish Power Transmission who are operating and known as Scottish Power Energy Networks (SPEN), the Applicants. The Project comprises a 2-gigawatt (GW) high voltage direct current (HVDC) cable system linking Lincolnshire in England and Fife in Scotland. A full project description is provided in Section 3.1 and will comprise the English onshore scheme connecting the landfall in Lincolnshire with two convertor stations, one in the vicinity of the Direct Current Switching Station near East Lindsey, Lincolnshire and one near Walpole. The marine scheme comprises approximately 525 km of subsea HVDC cable from Lincolnshire to the Fife landfall either at Kinghorn or Largo Bay, and the Scottish onshore scheme which connects the selected landfall in Fife to the Scottish transmission system at Westfield.

This Scoping Report has been produced specifically for the Project's Marine Scheme, which comprises the components proposed from the Mean High-Water Springs (MHWS) mark at the proposed English Landfalls to the MHWS mark at the proposed Scottish Landfalls, through English and Scottish territorial waters and the UK Exclusive Economic Zone (EEZ).

There are two proposed Landfalls in England and two proposed Landfalls in Scotland being considered at this stage of the environmental assessment process. These options will be subject to further technical feasibility work and stakeholder consultation and will be refined to one preferred option for inclusion in the subsequent Marine Licence applications for the Project.

A schematic diagram shown below in Figure 1-1 illustrates the concept and main infrastructure of the Project.

Figure 1-1: Project Schematic

1.2. Screening

As the Project traverses through English and Scottish waters, the Applicants are intending to apply for two Marine Licences for the construction, operation and maintenance of the Project; one application will be made to the Marine Management Organisation (MMO) under the Marine and Coastal Access Act 2009 (MCAA); and one to the Marine Directorate – Licensing Operations Team (MD-LOT) under the Marine (Scotland) Act 2010.

The Applicants recognise that they will be required to provide environmental information in support of their Marine Licence Application (MLA). For example, the Applicants are required to demonstrate that the potential beneficial and adverse effects of the project on UK designated sites have been considered; and that the effects of the Project have been considered in accordance with the Water Framework Directive (WFD). In addition, the MMO and MD-LOT (the Regulatory Authorities) will engage with statutory consultees to ensure that due consideration has been given to navigational safety, historic environment and other marine stakeholders.

The MMO and MD-LOT are of the opinion[1], having reviewed the projects listed in Schedule A1 and Schedule A2 of The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) (MWR), that the Project does not constitute either a Schedule 1 or Schedule 2 development. The Project is therefore not required to be screened by agreement or determination and both a statutory Environmental Impact Assessment (EIA) and an Environmental Statement (ES) are not required.

To meet their obligations, and to ensure that the marine environmental assessment is presented to the MMO, MD-LOT and consultees in a consolidated and concise manner, the Applicants intend to carry out a Marine Environmental Assessment (MEA) and submit a Marine Environmental Appraisal (MEAp) to support the MLA.

1.3. Scoping Opinion and Scoping Report Objectives

As outlined above, the Applicants are of the opinion that the best way to meet their obligations is to undertake an MEA and provide an MEAp. To ensure that the Applicants prepare a focused but robust MEAp, the Applicant is requesting a Scoping Opinion from the MMO and MD-LOT. This is an opportunity for the Regulatory Authorities and key marine stakeholders to make representations regarding the scope of the Applicant's MEA and subsequent MEAp. It also provides an opportunity for stakeholders to raise any issues that they consider to be relevant to the assessment process.

This Scoping Report has been prepared to inform the Scoping Opinion. It sets out the views of the Applicants as to the proposed scope of the environmental issues to be considered in the MEA and the method by which assessment will be undertaken. The specific objectives of this Scoping Report are to:

- Describe the nature of the Project (the English and Scottish marine components of the Project, the Marine Scheme).
- Provide a baseline for each environmental topic.
- Describe the likely effects of the Project on each topic, including identifying those that are potentially significant. Topics or issues that are proposed to be scoped out of the MEA are also described and justified.
- Provide the scope of assessment for each topic to be included in the MEAp.

This Scoping Report covers both English and Scottish jurisdictions with the English components presented first in each chapter.

1.4. Scoping Boundary

This Scoping Report relates to the marine components of the Project. The proposed submarine cable corridor is illustrated in Figure 1-2 (Drawing: C01494-EGL4-LOC-012) and extends from the MHWS mark at the proposed English Landfalls to the MHWS mark at the Scottish Landfall through English and Scottish territorial waters and the UK Exclusive Economic Zone (EEZ). The proposed submarine cable corridor extends for approximately 419 km in English waters and 106 km in Scottish waters.

The Scoping Boundary has been defined as the extent of the proposed submarine cable corridor, within which the cables will be laid, and all marine works will be conducted. The Scoping Boundary is nominally 1 km wide, 500 m either side of the centreline, however, it widens in areas where there is still optionality in the design e.g., to allow for micro-routeing around potential seabed features. It is anticipated that the marine licence application boundary will ultimately be 500 m following refinement and rationalisation as the MEA and design process evolves.

[1] Advice received from MD-LOT via email on 19/01/2023 and from MMO via email on 10/02/2023.

EGL 4 Scoping Boundary

C01494b-EGL4-LOC-012-C

- Exclusive Economic Zone Limit (EEZ)
- 12NM Limit
- Scottish Adjacent Waters
- EGL 4 Scoping Boundary
- Landfall Site

0 25 50 NM

0 50 100 km

Date	21/12/2023
Coordinate System	ETRS89 / UTM Zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	Meters
Scale at A3	1:1,820,000
Created	EP
Reviewed	S Pearce
Authorised	A Farley

Document Path: X:\GIS\GIS_PROJECTS\C01494_EGL3&4\Project\QGS\EGL4\01_LOC\C01494_EGL4_LOC_012.qgz

Export Date: 21/12/2023

1.5. The Applicants

In England the MLA will be submitted by National Grid Electricity Transmission (NGET). In Scotland the MLA will be submitted by Scottish Power Energy Networks (SPEN).

NGET is a division of National Grid plc. There are four distinct electricity business entities under the umbrella of National Grid Group plc in the UK, as detailed in Figure 1-3 below, all with different roles and responsibilities. NGET is the Transmission Operator (TO) for England and Wales, meaning they own and manage the high-voltage electricity transmission network in these countries.

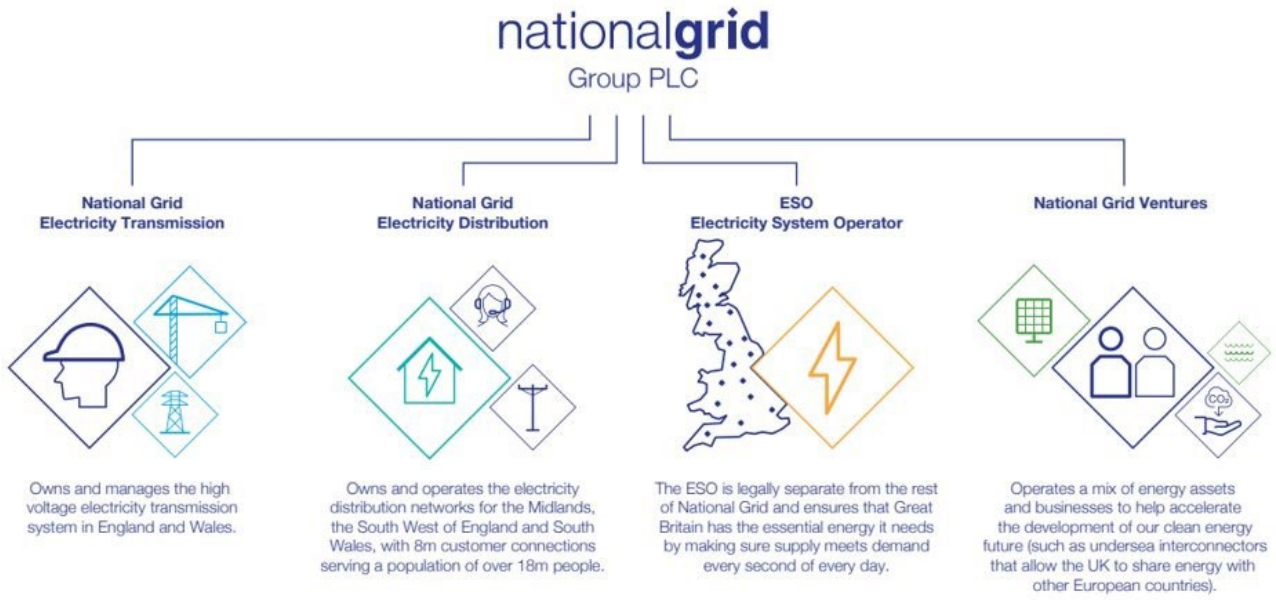

Figure 1-3: National Grid Group plc structure overview

SPEN is the Transmission Owner (TO) for central and southern Scotland, and similar to NGET, are responsible for ensuring electricity is transmitted safely and efficiently from generation to user.

NGET and SPEN are both transmission license holders under the Electricity Act 1989 and have a number of statutory duties which include the requirement "*to develop and maintain an efficient, coordinated and economical system of electricity transmission*" as well as specific responsibilities under Schedule 9 with regard to the preservation amenity.

1.6. Policy and Legislative Context

This section provides an overview of the policy and legislation that govern the Project. Whilst the Project would be developed and constructed within the UK, as it crosses between English and Scottish waters there are slight differences in the governing legislation due to the two devolved administrations. This section therefore presents both the English and Scottish context. It should be noted that as well as a marine licence, the Project will require other permits, licences and approvals from other consenting bodies. These are not discussed in this Scoping Report.

The United Nations Convention on the Law of the Sea (UNCLOS) is equally applicable in England and Scotland within territorial waters and provides levels of protection at an international level for all international submarine cables. Amongst other provisions UNCLOS provides the freedom to lay, maintain and repair cables on the continental shelf (beyond 12NM). Article 79 of UNCLOS provides this freedom and states that the coastal States (e.g., MMO and MD-LOT, when exercising their licensing function) may not impede the laying or maintenance of such cables or pipelines. To ensure compliance with this, Section 81 of the Marine and Coastal Access Act (MCAA) 2009, applicable to both England and Scottish water beyond 12 NM sets out an exemption for such projects.

1.6.1. England

Under The Marine and Coastal Access Act 2009, a Marine Licence is required for certain activities that are carried out within the UK marine area. The MMO is responsible under Part 4 of the MCAA for administering marine licensing of activities related to construction or removal of any substance or object in English territorial waters and also for regulating activities where they are undertaken outside of English territorial waters e.g., within the English EEZ.

A review of current marine licencing policy indicates:

- Laying and burial of the submarine cables within territorial waters (i.e., within 12 nautical miles (NM)) requires a Marine Licence under Part 4 of the MCAA.
- Within the offshore marine plan area (outside of 12 NM), the installation of an international electricity cable is exempt from requiring a Marine Licence under Section 81(2) of the MCAA. However, the placement of cable protection material e.g., concrete mattresses or rock would be licensable activities.
- The MMO consider that any form of cable protection works is a licensable activity, whether the need for such protection works is identified before or after the laying of the cable. Cable protection can be included in a MLA.

When determining a Marine Licence, the MMO has a responsibility to ensure that the application complies with the requirements of a range of UK and English legislation. However, for international submarine power cable applications, the MMO are obliged to grant a Marine Licence (within English territorial waters), although conditions can be included in any Marine Licence issued. To ensure compliance with necessary UK legislation, environmental information can be requested in order to determine the licence. The relevant regulations and types of assessment that the MMO are obliged to consider are described in Table 1-1.

There is a range of topic-specific guidance which may be of relevance to the assessment of potential impacts on specific receptors. For brevity, neither topic-specific legislation or guidance is reported here and is instead detailed within each chapter of the Scoping Report as appropriate.

Table 1-1: Regulations which the Project in England must comply with

Regulations	Description	Actions to be taken by the Applicant
Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) (MWR) [2]	The MWR require that certain types of projects with the potential to significantly affect the environment have an EIA before a marine licence decision is made. The MMO checks all applications to assess them for the potential to require an EIA. The installation of cables or the deposit of cable protection is not listed in Schedule A1 or A2 of the MWR as the type of project that would require a statutory EIA.	As a responsible developer, the Applicants have chosen to fulfil the obligations by undertaking a MEA and submitting a MEAp. The content of this process is the subject of this Scoping Report.
Marine and Coastal Access Act 2009 (MCAA) - Marine Spatial Plans	Under Section 58 of the MCAA, the MMO is required to make decisions in accordance with marine policy documents, and as such is responsible for implementing the relevant Inshore and Offshore Marine Plans through existing regulatory and decision-making processes. In assessing marine licence applications, the MMO must determine whether the activities of the proposed development are compatible with the objectives of the Marine Policy Statement (MPS) and the relevant marine plan(s). The UK MPS provides the policy framework for the marine planning system and the context for Marine Plans. Marine Plans, where they exist, put into practice the objectives for the marine environment that are identified in the MPS alongside the National Planning Policy Framework (NPPF) and the Localism Act 2011. The Project lies within the North East Offshore Marine Plan and East Inshore and Offshore Marine Plan.	Information to demonstrate that the proposed development is in accordance with the MPS and relevant Marine Plans will be provided by the Applicant with the Marine Licence application. This will take the form of a table setting out each policy objective with a description of how the features of the proposed development comply with the objective.
Marine Strategy Regulations 2010	The UK Marine Strategy consists of a simple 3-stage framework for achieving Good Environmental Status (GES) in our seas. Achieving GES is about protecting the marine environment, preventing its deterioration and restoring it where practical, while allowing sustainable use of marine resources. The strategy covers 11 elements (known as descriptors) including: biodiversity; non-indigenous species; commercial fish; food webs; eutrophication; sea-floor integrity; hydrographical conditions; contaminants; contaminants in seafood; marine litter and underwater noise. The UK Marine Policy Statement clearly identifies the Marine Strategy Framework Directive (2008/56/EC (MSFD)) as one of the environmental legislative provisions that should be considered in the marine planning process and, where appropriate, reflected in marine plans. The MSFD requires Member States to take measures to achieve or maintain GES for their seas by 2020. It came into force on 15 July 2008 and was transposed into UK law by the Marine Strategy Regulations 2010. Marine plans will contribute to meeting the objectives of the MSFD, particularly in relation to any measures which have a spatial dimension. The MMO will consider how marine plans may shape activities within the relevant marine area to support the goals of the MSFD, as well as those of other relevant pieces of legislation.	As described above the information to demonstrate that the proposed development is in accordance with the relevant Marine Plans will be provided by the Applicant with the Marine Licence application.

[2] Changes to the EIA Directive were translated into an updated MWR as of 16 May 2017.

Regulations	Description	Actions to be taken by the Applicant
	Marine plans set the direction for the licensing and consenting process. Public authorities must take any authorisation or enforcement decision in accordance with the UK Marine Policy Statement 2011 and marine plans unless relevant considerations indicate otherwise.	
The Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2017 (as amended)	The sea from Mean Low Water Spring (MLWS) to 1 NM from shore is protected under The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 which require that the project or activity does not 'cause or contribute to deterioration in water body status' or 'jeopardise the water body achieving good status'. For licence applications in this zone, the MMO must ensure that the marine licence decision is compatible with the 2017 Regulations (as amended) and any river basin management plan. The Environment Agency is the competent authority for the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, and it advises the MMO prior to a licensing decision. The Environment Agency's assessments and conclusions inform the MMO decision.	The scoping template provided by the Environment Agency will be completed as part of the MEA process and submitted with the Marine Licence application. Please refer to Chapter 6 for further details.
Conservation of Habitats and Species Regulations 2017 (covers inshore waters out to 12 NM) (COHSR) Conservation of Offshore Marine Habitats and Species Regulations 2017 (covers offshore waters from 12 NM out to the EEZ boundary) (COMHSR)	The CHSR and COMHSR are collectively referred to as the Habitats Regulations. They transpose into UK law the requirements of Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and Council Directive 2009/147/EC on the conservation of wild birds the Birds Directive). The Habitats Regulations established within the UK Special Areas of Conservation (SACs) to promote the protection of flora, fauna and habitats, and Special Protection Areas (SPAs) to protect rare, vulnerable, and migratory birds. These 'European Sites' form part of a network of internationally important sites across Europe. Under the Habitats Regulations, the competent authority (the MMO) is required to undertake a Habitats Regulations Assessment (HRA) to determine whether there is potential for a plan or project to have an adverse effect on a European Site, alone or in-combination with other plans or projects. The HRA process comprises four key stages including the assessment of Likely Significant Effects (LSE), Appropriate Assessment (determining the implications of the plan or project on the integrity of a European site in view of that site's conservation objectives), assessment of alternative solutions and Imperative Reasons of Overriding Public Interest (IROPI). Under Regulation 63(1) of the Habitats Regulations, the Appropriate Assessment is undertaken by the competent authority based on information provided by the applicant, usually in the form of a Report to Inform an Appropriate Assessment (RIAA) or an HRA Report. When undertaking an HRA, it is also necessary to consider potential effects on proposed SPAs (pSPAs), candidate SACs (cSACs) and Ramsar sites.	The Applicant will provide information to inform screening for Appropriate Assessment. If screening identifies that Appropriate Assessment is required for any European Site, then the Applicant will provide a Report to Inform Appropriate Assessment with the Marine Licence application. Please refer to Chapter 5 for further details.
MCAA – Marine Conservation Zones (MCZ)	Section 126 (6) of the MCAA requires that Applicants seeking to undertake an activity must satisfy the competent authority (the MMO) that there is no significant risk of the proposed activity hindering the achievement of the conservation objectives stated for the MCZ. The MMO follows an MCZ assessment process that is integrated into existing marine licence decision making procedures. There are three stages to the assessment process including Screening (the process of identifying whether S.126 should apply to the proposed development and whether the activity is capable of affecting (other than insignificantly) either the protected features of the MCZ or the ecological or geomorphological processes on which the protected features are dependent); Stage 1 assessment (which considers whether there is a significant risk of the activity hindering the achievement of the conservation objectives stated for the MCZ) and Stage 2 assessment (which considers whether there are benefits to the public of proceeding with the project that clearly outweigh the damage to the environment and what measures the applicant will take to provide equivalent environmental benefit to compensate for the damage which the project will have on the MCZ).	The Applicant will provide information to inform MCZ Screening. If screening identifies that Stage 1 Assessment is required for any MCZ, then the Applicant shall provide a Report to Inform Stage 1 Assessment with the Marine Licence application. Please refer to Chapter 5 for further details.
Wildlife and Countryside Act 1981 (as amended)	Sites of Special Scientific Interest (SSSI) are identified and protected by Natural England (NE) under the Wildlife and Countryside Act 1981 (as amended). Sites are selected to protect biological interests (e.g., rare or best examples of flora and fauna and supporting habitats) or geological or geomorphological interests (e.g., strata containing important geological stratigraphy or fossils). NE's objective is to achieve 'favourable condition' status for all SSSIs. Favourable condition means that the SSSI's habitats and features are in a healthy state and are being conserved by appropriate management.	The Applicant will provide information to inform the SSSI Assessment within the Designated Sites Chapter of the MEAp. Please refer to Chapter 5 for further details.

Regulations	Description	Actions to be taken by the Applicant
	Each SSSI has a list of activities, known as 'operations', which need NE's written consent before they can proceed. To arrive at a decision, NE will assess whether proposals to carry out operations within a SSSI have a positive or negative effect on the condition of a site. Where the Project overlaps with a SSSI, the MMO will consult NE on the proposed plans and activities. NE's assessments and conclusions inform the MMO's decision, and the Marine Licence forms the necessary consent to undertake operations within the SSSI.	
MCAA - Shipping & Navigation	Section 69(1c) of the MCAA requires the MMO to have regard to the need to prevent interference with legitimate uses of the sea. Any deposits must not pose a navigational risk. To inform their decision the MMO will consult with navigational bodies. The Maritime and Coastguard Agency (MCA) is the primary advisor on navigational safety issues, but representations are also sought from Trinity House, the Royal Yachting Association (RYA), Chamber of Shipping and any port authority within the proposed development area (which for the Project may include Humber Port Authority).	A Navigation Risk Assessment will be used to inform the MEA and will be provided with the MEAp. Please refer to Chapter 11 for further details.
MCAA - Marine Archaeology	Section 69(1a) of the MCAA requires the MMO to have regard to the need to protect the environment. This includes certain archaeological regulations that must be complied with e.g., the Protection of Wrecks Act 1973 (PWA), the Ancient Monuments and Archaeological Areas Act 1979, and the Protection of Military Remains Act 1986. To ensure due consideration is given to marine archaeology certain marine archaeological assessments need to be provided to ensure that effects on archaeology are understood. The MMO will consult with Historic England on the findings of the assessments to inform their licensing decision.	Marine archaeological assessments will be undertaken by a qualified marine archaeologist to inform the MEA process, the conclusions of which will be presented in the MEAp. The scope of these assessments is described in Chapter 14.
The Waste (England and Wales) Regulations 2011	The MMO must ensure that waste generated by the Project is dealt with in an environmentally appropriate way before it can grant a licence. To do this it applies the waste hierarchy, which gives an order of preference for how waste is dealt with: • Prevention – this can include not carrying out an activity and the refusal of a marine licence • Re-use – finding an alternative, beneficial use for waste material • Recycling – this can include making high grade products from waste material • Other recovery - including treatment to alter the physical nature of the waste material disposal at sea – this is the last resort	The Applicant shall take all such measures as are reasonable in the circumstances to apply the waste hierarchy to prevent waste, and to apply the hierarchy as a priority order when transferring waste to another person.

1.6.2. Scotland

Similar to England, a Marine Licence is required for certain activities that are carried out within the UK marine area. MD-LOT is the regulator responsible for determining marine licence applications in Scottish waters, however the licensing regime differs slightly to England.

A review of current marine licencing policy indicates:

- Laying and burial of the submarine cables within territorial waters (i.e., within 12 nautical miles (NM)) requires a Marine Licence under the Marine (Scotland) Act 2010.
- Within the Scottish offshore region (between 12 and 200 NM), licensing falls under the Marine and Coastal Access Act 2009, however as with England, within territorial waters the installation of an international electricity cable is exempt from requiring a Marine Licence under Section 81(2) of the MCAA. The placement of cable protection material e.g., concrete mattresses or rock would still be licensable activities.

Under the Marine (Scotland) Act 2010 when determining a Marine Licence, MD-LOT has a responsibility to ensure that the application complies with the requirements of a range of Scottish legislation. However, for international submarine electricity cable applications, MD-LOT are obliged to grant a Marine Licence (within Scottish territorial waters), although conditions can be included in any Marine Licence issued. To ensure compliance with necessary UK legislation, environmental information can be requested in order to determine the licence. The relevant regulations and types of assessment that MD-LOT are obliged to consider are described in Table 1-2.

Table 1-2: Regulations which the Project in Scotland must comply with

Regulations	Description	Actions to be taken by the Applicant
The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended)	These regulations cover the area within 12 NM of the Scottish coastline and from 12 NM to the edge of the EEZ. They require that certain types of projects with the potential to significantly affect the environment have an EIA before a marine licence decision is made. MD-LOT checks all applications to assess them for the potential to require an EIA. The installation of cables or the deposit of cable protection is not listed in Schedule 1 or 2 of the MWR as the type of project that would require a statutory EIA.	As a responsible developer, the Applicant has chosen to fulfil its obligations by undertaking a MEA and submitting an MEAp. The content of this process is the subject of this Scoping Report.
Marine and Coastal Access Act 2009 (MCAA) - Marine Spatial Plans	As in England, under Section 58 of the MCAA, MD-LOT is required to make decisions in accordance with marine policy documents, and as such, is responsible for implementing the Scottish National Marine Plan through existing regulatory and decision-making processes. In assessing marine licence applications, MD-LOT must determine whether the activities of the Project are compatible with the objectives of the UK MPS and the Scottish National Marine Plan (NMP).	Information to demonstrate that the proposed development is in accordance with the UK MPS and the Scottish NMP will be provided by the Applicant with the Marine Licence application. This will take the form of a table setting out each policy objective with a description of how the features of the Project comply with the objective.
MCAA - Shipping & Navigation	The requirements of the MCAA in relation to shipping and navigation apply in Scotland as well. To inform their decision MD-LOT will consult with navigational bodies. The Maritime and Coastguard Agency (MCA) is the primary UK advisor on navigational safety issues, but representations are also sought from Trinity House, the Royal Yachting Association (RYA) and any port authority within the proposed development area (which for the Project may include Peterhead Port Authority).	A Navigation Risk Assessment will be used to inform the MEA and will be provided with the MEAp. Please refer to Chapter 11 for further details.
MCAA - Marine Archaeology	The requirements of the MCAA in relation to marine archaeology apply in Scotland as well. To inform their decision MD-LOT will consult with Historic Scotland on the findings of the assessments to inform their licensing decision.	Marine archaeological assessments will be undertaken by a qualified marine archaeologist to inform the MEA process, the conclusions of which will be presented in the MEAp. The scope of these assessments is described in Chapter 14.
Marine (Scotland) Act 2010 – Marine Protected Areas (MPA)	The Marine (Scotland) Act 2010 ("the Act") provides a statutory framework for the management of the marine environment in Scotland's inshore waters (up to 12 NM from the coast). In UK offshore waters, including around Scotland, an equivalent framework is provided by the Marine and Coastal Access Act 2009. The Act allows for the designation of marine protected areas (MPAs) for nature conservation purposes in Scottish waters. MPAs are used to ensure protection of some of the most vulnerable species and habitats. A detailed consideration of the MPA assessment process as relevant to the Project is provided within Chapter 5 and for brevity, is not repeated here.	The Applicant will provide information to inform MPA Screening. If screening identifies that Stage 1 Assessment is required for any MPA, then the Applicant shall provide a Report to Inform Stage 1 Assessment with the Marine Licence application. Please refer to Chapter 5 for further details.
CHSR and COMHSR	As described in Table 1-1 the CHSR and COMHSR also apply in Scottish waters. In Scotland the competent authority is MD-LOT.	The Applicant will provide information to inform screening for Appropriate Assessment. If screening identifies that Appropriate Assessment is required for any European Site, then the Applicant shall provide a Report to Inform Appropriate Assessment with the Marine Licence application. Please refer to Chapter 5 for further details.
Wildlife and Countryside Act 1981 (as amended) Nature Conservation (Scotland) Act 2004	As described in Table 1-1, the Wildlife and Countryside Act also applies in Scotland. SSSIs are identified and protected by NatureScot. The Nature Conservation (Scotland) Act 2004, Part 3 and Schedule 6 make amendments to the Wildlife and Countryside Act (1981 as amended), strengthening the legal protection for threatened species to include 'reckless' acts. Within each SSSI, NatureScot have identified activities, that may damage the designated features, which need written consent before they can proceed. These are know as "Operations Requiring Consent. To arrive at a decision, NatureScot will assess whether proposals to carry out operations within a SSSI have a positive or negative effect on the condition of a site. Where the proposed development overlaps with a SSSI, MD-LOT will consult NatureScot on the proposed plans and activities. NatureScot's assessments and conclusions inform MD-LOTs decision, and the Marine Licence forms the necessary consent to undertake operations within the SSSI.	The Applicant will provide information to inform the SSSI Assessment within the Designated Sites Chapter of the MEAp. Please refer to Chapter 5 for further details.

2. Project Need and Alternatives

2.1. Introduction

Options appraisal is an integral part of the Project development. The requirements to consider reasonable alternatives in the design of a project is set out in Schedule 3 paragraph 2 of the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended). Although the Project will not require a statutory EIA, the Applicants, as a matter of best practice (and under Schedule 9 of the Electricity Act 1989 which places an obligation to preservation of amenity), and in line with the requirements of the English and Scottish Habitats Regulations and Offshore Habitats Regulations[3], will be undertaking marine environmental assessments to the same standard. The EIA Regulations require that the developer provide *"A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the applicant, which are relevant to the proposed project, the regulated activity and their specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."* Under the Habitats and Offshore Habitats Regulations, if the Appropriate Assessment process concludes that a project will have an adverse effect on the integrity of a European site (i.e., Special Areas of Conservation and Special Protection Areas), the Applicant must be able to demonstrate that all reasonable feasible alternatives have been assessed and that the least potentially damaging option has been selected.

Options appraisal is used by the Applicants to consider the implications of the selection of certain options when developing infrastructure projects. This chapter seeks to demonstrate that reasonable feasible alternatives have been, and will continue to be, considered during the design and development of the Project. The overall aim of the process is to ensure that the final Project design has assessed and adequately mitigated all potential environmental effects from a physical, biological and socio-economic perspective whilst ensuring that it delivers on the Projects objectives of providing essential additional electricity transmission capability between Scotland and England.

The structure of this section (as outlined in Table 2-1) follows sequentially the decision-making process that has led to the design presented in the Scoping Report. It should be noted that all information in this section is based on the best available information at the time of writing. Engagement with stakeholders on offshore cable routeing is ongoing and will continue to influence the consideration of alternatives.

Table 2-1: Structure of Chapter 2

Section		Description
2.2	Need for the Project	This sub-section outlines the national policy driving the need for the Project and the public benefits addressed by its development.
2.3	Objectives of the Project	This sub-section defines the core and secondary objectives which must be fulfilled by any feasible solution.
2.4	Alternative solutions that can be discounted immediately	This sub-section identifies the alternative solutions that have been discounted immediately because they do not meet the core project objectives. It includes: • Do-nothing • Alternative transmission options • Reduce electricity demand
2.5	Alternative solutions that are feasible alternatives	This sub-section identifies all feasible alternative solutions and justifies why the selected solution has been selected. It has been split into the following sub-sections: • Alternative technology • Alternative national connection points • Alternative landfall sites • Alternative offshore cable routes • Alternative installation techniques

[3] Conservation of Habitats and Species Regulations 2017 (as amended) (England) and Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (Scotland) and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended)

2.2. Need for the Project

This section explains the importance of energy infrastructure, enhancing security of supply and maintaining a properly functioning energy market. Under the newly inforced National Policy Statement EN 3 new onshore and offshore network infrastructure and related network reinforcements for the provision of nationally significant offshore wind dvelopment has been conculded by the governrment to be Critical National Priority Infrastructure.

The UK is a world leader in offshore wind energy and its target of becoming net-zero in all greenhouse gases by 2050 for England and Wales and 2045 for Scotland is enshrined in Law. The Energy White Paper (2020) (BEIS, 2020) sets out government targets of increasing offshore wind capacity to 40 GW by 2030 to accelerate the transition to Net Zero. This target has since been increased to 50 GW by 2030, as detailed in the Energy Security Strategy (2022) (BEIS, 2022). In addition, the Scottish Government, in its Draft Energy Strategy and Just Transition Plan (2023), has set a new target for an additional 20GW of new low carbon renewable electricity generation by 2030, including 12GW of new onshore wind and potentially increasing its current offshore wind target of 11GW by 2030 on which is has consulted, with its final Energy Strategy and Just Transition expected by summer 2024.

North Sea developments, including offshore wind, interconnectors and transmission system reinforcements will be essential in meeting these climate change targets and driving economic growth across the UK. This Project will form an integral part of the UK transmission network and is not an interconnector.

As the UK moves away from using traditional fossil fuels to power vehicles and heat homes, there will be a greater need for renewable and low carbon energy. To be able to move to these renewable and low carbon forms of energy, the UK needs to increase the capability of the electricity transmission network to be able to accommodate it.

The British Energy Security Strategy set out the United Kingdom (UK) Government's ambition to connect up to 50 GW of offshore generation to the electricity network by 2030. This will require additional network capacity and greater power transfer capability across the Anglo-Scottish border. To assist in bringing Scotland's vast reserves of renewable energy to the rest of the UK, the National Grid ESO Network Options Assessment (NOA) (National Grid ESO, 2022) and the Pathway to 2023 Holistic Network Design recommended four new HVDC Links. These are: Eastern Green Link (EGL 1) which would run from Torness, near Edinburgh to Hawthorn Pit in County Durham; EGL 2 which would run from Peterhead in Aberdeenshire to Drax, North Yorkshire; Eastern Green Link 3 (EGL 3), which would run between Peterhead in Aberdeenshire to Lincolnshire; and Eastern Green Link 4 (EGL 4) (this Project), which would run between Fife in Scotland to Lincolnshire, in England.

In 2022, Ofgem (the UK energy regulator) undertook consultation to determine how they could support the accelerated delivery of the strategic electricity transmission network upgrades need to meet the Governments 2030 targets. This led to the introduction of a new Accelerated Strategic Transmission Investment (ASTI) framework. The EGL 4 project has been listed as an ASTI project, which means it will benefit from an accelerated regulatory framework, recognising its importance in supporting the UK meet its Net Zero targets.

2.3. Objectives of the Project

When developing a new project, it is important to establish what the key objectives of the Project are. These are then used to establish whether the alternative solutions proposed during the feasibility and development stages are viable solutions that fulfil the desired outcomes. The objectives for the Project have been derived from the UK Government Net Zero targets, the objectives of NOA and the UK Holistic Network Design (HND), the Marine Policy Statement (MPS) and the relevant inshore and offshore marine plans. Table 2-2 outlines these objectives.

Table 2-2: Objectives of the Project

Objective		Basis of Objective
Core Objectives		
1	Develop a transmission reinforcement link between the Scottish and the English electricity transmission networks.	To meet the power transfer requirements of over 20 GW by 2030 and 30 GW by 2035 across the Anglo-Scottish border. (National Grid ESO, 2022).
2	Project commissioning by 2030.	To provide a recommended onshore and offshore network to meet the Government ambitions of connecting 50 GW of offshore wind in Great Britain (GB) by 2030. (National Grid ESO, 2022).
3	Seek to coordinate and co-locate infrastructure to minimise the impacts on the environment and communities as far as possible.	To facilitate the objectives set out in government policy, the Offshore Transmission Network Review (OTNR) and HND, and to mitigate negative impacts on local communities and landscape, in accordance with the joint statement dated 7 July 2022. (See paragraph 3.3.54 EN-1 (DESNZ (2023)).

Objective		Basis of Objective
4	Project infrastructure should be realistic to consent and deliver.	Proposals will consider all environmental and technical constraints to ensure that the Project can be delivered both economically and with a minimal environmental impact. This will allow it to be permitted responsibly in line with key guidance and policy.
Secondary Objectives		
5	Deliver the most efficient offshore and onshore cable routes.	Develop the shortest and least constrained route, balancing length, environmental, technical and economic constraints. Route should be optimised to allow burial in seabed sediments and avoid features where burial is not possible. Avoid constraints that cannot be physically moved in order to install the cables or will have severe/major financial and legal implications e.g., constrained navigation channels, wrecks, offshore oil and gas platforms, or physical implications on the route e.g., large expanses of rock or areas of sandwaves. Avoid areas of seabed used by others e.g., marine aggregate sites, disposal sites, renewable energy sites, ports and anchorage areas. Avoid or minimise the number of third-party asset crossings.
6	Ensure that the construction, operation and eventual decommissioning of the Project can be undertaken in a safe and efficient manner.	The safety and amenity of neighbours and workers is central to its design, delivery and decommissioning.
7	To minimise disruption to onshore communities.	The Applicants will endeavour to minimise long term disruption, either alone or in combination, with other developments in the region, through consultation with local authorities and communities, and the design and management of the Project.
8	To avoid where possible, or otherwise minimise the distance through which the route crosses designated sites.	Minimise likely significant effects or adverse effects on designated sites and species, in accordance with conservation policy and legislation, and the conservation objectives of the designated site.
9	To minimise disruption to shipping.	Through consultation with the local Port Authorities and other navigation stakeholders, the design and management of the Project seeks to not give rise to unsatisfactory risk to other sea users, particularly in areas of higher use and that it safeguards protected navigable depths within port authority waters.
10	To minimise disruption to commercial fishing.	Through consultation with appropriate Fisheries Associations, that the design and management of the Project does not give rise to long term displacement either alone or in combination with other developments in the region.

2.4. Alternative Solutions Discounted Immediately

Several alternative solutions were discounted immediately as being neither reasonable or feasible because they either were not supported by UK policy, or they will not achieve the core project objectives. These were:

- **Do nothing** – This option dictates that the transmission system must remain the same and constrains the transmittal of electricity when generation exceeds demand. It does not meet the UK policy objectives, nor does it meet the Project needs or deliver any of the core project objectives.
- **Alternative transmission options** – As part of the review for the connection of two new HVDC links in the Lincolnshire area (EGL 3 and EGL 4), the Applicants considered whether currently available alternative technology options, including High Voltage Alternating Current (HVAC) and HVDC based onshore options using overhead line technology solutions, should be further investigated. Findings from this review were that:
    - HVDC links over the proposed distance have comparable capital costs to the required HVAC solution, but much lower lifetime costs over this distance than the alternative onshore HVAC option. HVAC options are often the most economic when their distance is under multiple hundreds of kilometres, but in this case the proposed connections are in the order of 500 kms or greater where HVDC represents the economical and viable technology choice.
    - A fully onshore solution would consist of a substantially long route length, carrying a much higher delivery risk than the HVDC subsea cable reinforcement proposals (EGL 3 and EGL 4) that are currently being progressed and this would not be possible to deliver by the 2030 timescale that is required by the system need.
    - Consequently, an option using overhead line technology (OHL) is not considered to be the right alternative in this case as the distances involved make subsea HVDC a more viable, economical, deliverable and electrically controllable solution.
- **Reduce electricity demand** - This solution would not meet any of the core project objectives and is complementary (not an alternative) to the project need served by the Project. The National Energy and Climate Plan (NECP) (BEIS, 2021) states that "to meet the England and Wales 2050, and Scotland 2045 climate change targets, emissions from buildings

will need to be near zero, coupled with action on industrial processes." To meet the drive for decarbonisation, sectors across the economy are switching to electricity, driving up electrical demand. Energy demand management will play an important role in the future energy balance but cannot on its own deliver the decarbonised energy system. Different pathways will need to be developed concurrently such as reduced use of high carbon fossil fuels, increased energy efficiency, investment in renewables, more decentralised energy and a greater level of interconnection and transmission. This solution is therefore akin to 'do nothing' as it does not meet the UK policy objectives for decarbonisation on its own, does not meet the Project need and does not entirely deliver any of the core project objectives.

2.5. Alternative Solutions that are Feasible Alternatives

2.5.1. Alternative Technology

There are two viable options for transporting electricity: HVDC technology and HVAC technology.

The UK onshore electricity transmission networks operate as HVAC systems in which the direction of the current changes on average fifty times a second. The capacity of HVAC subsea cables reduces significantly with distance, with long lengths of HVAC cable requiring electrical compensation to be installed, typically every 50 km. Electrical compensation requires a large shunt reactor which needs to be installed on a small, fixed platform (like that used by the oil and gas industry). HVDC does not require electrical compensation (therefore reducing the footprint of the Project) and operates over much longer distances more efficiently. As a result of this higher efficiency of power transmission in HVDC cables, fewer materials (e.g., copper or aluminium) are required for cable manufacture, ultimately leading to fewer cables being required. Through previous project experience this translates into cost savings for the Project (which are passed on to consumers) and a lower environmental impact as fewer resources are required in comparison to a HVAC system.

The Marine Scheme proposes the use of HVDC technology because it is more effective at transmitting high electricity capacity over longer distances with lower energy losses than an equivalent High Voltage Alternating Current (HVAC) system. Additionally, a HVDC technology system provides a greater degree of control over the magnitude and the direction of power flow, eliminating the requirement for synchronisation between the electricity systems at either end of the link.

2.5.2. Alternative National Connection Points

The first stage of the project development process is to identify where the reinforcement cables will connect to the transmission network in Scotland and England. The TOs identified Fife, Scotland and Lincolnshire, England as the optimal connection points for the Project.

In England, Lincolnshire was initially identified as the National Grid connection point, whereby a connection node for the Project and for other National Grid customers would be constructed. However, after understanding the number of schemes that were looking to connect terrestrially to this same area, it was deemed that there needed to be a scope change to avoid a delay in delivery of EGL 4, as the construction of this connection point was reliant on the completion of another project.

For the Project to meet system capability needs, NGET made the decision to reduce the level of interaction and improve scheme deliverability by relocating the connection point of EGL 4 to a new substation in the Walpole area. This in-turn reduces the power infeed to Lincolnshire.

A key driver for the identification of connection points was to provide additional boundary capability across a number of GB transmission network boundaries, and specifically the B5 and B6 boundaries in Scotland and B9 boundary in England. The identification of Westfield substation in Fife as the preferred connection point is due to the location of the substation within the B5 transmission boundary on the east coast of Scotland. Starting at a site that is the furthest north within the SP Transmission licence area and closest to the east coast ensures maximum benefits to the network and minimum onshore works. Westfield is also the substation closest to the east coast which has four existing 275kV transmission circuits connecting into it. These lines are also proposed to be uprated to 400kV making it a strong connection point for EGL 4.

2.5.3. Alternative Landfall Sites

2.5.3.1. Approach

Landfall locations were initially identified though a review of publicly available and purchased mapped data. Data was classified according to whether it was a potential planning, physical, environmental, or human constraint on the development of the Project. Landfalls were identified based on the following criteria, (in no particular order of importance):

- Access to an onshore grid connection;
- Ground condition suitability;
- Site access both onshore and offshore;
- Alternative access available for landowners;

- Avoidance of existing infrastructure where possible;
- Potential environmental or socio-economic constraints (e.g., designated sites, populated areas or archaeological restrictions);
- Topography;
- Coastal sediments;
- Geomorphology of the shoreline including evidence of erosion/accretion;
- Potential to support either open cut or trenchless options at the landfall;
- Coastal defence or flood features; and
- Fishing activity.

Each landfall was assessed based on its own merits, technically and environmentally, taking into consideration any information available from other major developments in the region. They were also assessed in combination with the merits of the associated onshore and offshore cable route(s), to prove that the end-to-end solution meets the Project objectives.

2.5.3.2. England

In England, NGET have identified the Walpole Substation as the connection point for the Project. Following analysis of constraints and consultation with Natural England, strategic options appraisal discounted The Wash and North Norfolk coastline as landfall search areas for this project, primarily on nature conservation grounds.

A preliminary landfall search area was identified between the southern coast of the Humber Estuary and north-west corner of The Wash. An initial comparative red, amber, green (RAG) assessment was conducted based on the constructability of the landfall (due to technical and environmental constraints). This study identified three landfall locations on the Lincolnshire coastline; Horseshoe Point, Theddlethorpe Beach and Anderby Creek; noting that the location at Anderby Creek had multiple landfall options.

Horseshoe Point was discounted as a landfall option after consultation with stakeholders identified that the area is part of a pilot project for the re-introduction of seagrass and oysters. In addition, due to the presence of the Hornsea 1 and 2 offshore wind farm export cables the landfall would have a likely significant effect on saltmarsh habitat and the nearshore approach would be extremely constrained, with likely significant effects on access to Port facilities, safeguarding navigation depth and shipping and navigation on the Humber Approaches Channel. The proximity to the Donna Nook firing range and sea haul out site were also a consideration.

Theddlethorpe Beach and Anderby Creek are both being considered as landfall options in this Scoping Report, as land acquisition is still to be confirmed, therefore options need to remain open. Theddlethorpe Beach lies within the Saltfleetby-Theddlethorpe Dunes and Gibraltar Point SAC, Saltfleetby-Theddlethorpe Dunes SSSI and Humber Estuary SPA. Both landfalls lie within the Greater Wash SPA. The offshore approach to both landfalls shares several constraints. Whilst both avoid the River Humber Approaches Traffic Separation Scheme (TSS) they would require a crossing of the Hornsea 1 and 2 offshore wind farm export cables within an area of high-frequency shipping in relatively shallow water. In addition, the marine routes to Anderby Creek would require the crossing of four pipelines in shallow water. Engineering and environmental studies and stakeholder consultation is ongoing to understand the constraints and potential mitigation for both landfalls and a preferred option has not yet been selected.

2.5.3.3. Scotland

In Scotland, SPEN have identified Westfield, Fife as the optimal connection point for the Project. A preliminary landfall search area was identified, comprising of an approximately 30 km stretch of coastline from east of Aberdour/Silver Sands Bay to west of Lower Largo Bay. Four landfall zones and five landfalls were identified within this search area following a review of constraints by the terrestrial and marine technical and environmental teams and site visits. Landfalls were identified as Kinghorn North, Kinghorn South, Buckhaven, Lower Largo/Lundin Links and Largo Bay.

An initial comparative RAG assessment was conducted based on the constructability of the landfall (due to technical and environmental constraints). The assessment also considered the approach to the landfall from both an onshore and offshore perspective, as a landfall cannot be selected in isolation.

The assessment excluded the Buckhaven landfall as a viable option. The nearshore approach to the landfall was very complex with a large number of anchorages, an Exercise Area X5611 which is used by the Ministry of Defence and a Foul Ground which potentially contains old sodium phosphide mines. Although a marine route alignment was developed and substantial discussion was held with Forth Ports on the viability of moving or reducing the size of anchorages, the evaluation of the technical feasibility of the marine route alignment concluded that the proximity of the cable to the anchorages still presented a significant integrity risk to installed cables.

Kinghorn North has also been excluded as an option for this Project as it overlaps with the Kirkcaldy seal haul-out.

Kinghorn South and Lower Largo/Lundin Links are being considered as landfall options in this Scoping Report. Both landfalls lie within the Firth of Forth and Firth of Forth and St Andrews Bay Complex Special Protection Areas (SPAs). Kinghorn South is adjacent to the Kirkcaldy seal haul-out and an area of relatively higher shipping density, identified by Forth Ports as the area used by pilots for vessel

manoeuvres. However, it offers a shorter onshore cable route. The landfall site in Lower Largo/Lundin Links involves a shorter offshore route through the Outer Firth of Forth and St Andrews Bay Complex SPA and avoids the higher shipping densities but conversely the onshore route is substantially longer than to Kinghorn and subsequently more challenging.

These options will be subject to further technical feasibility work and stakeholder consultation and will be refined to one preferred option for inclusion in the subsequent MLA for the Project.

2.5.4. Alternative Offshore Cable Routes

Following the identification of potential landfall sites, it was possible to start identifying potential marine cable route options. The aim was to create the shortest marine cable route possible which will optimise the route to ensure the cable can be buried along its extent, minimise the length of cable needed, reduce the manufacturing and installation costs, and minimise the environmental footprint of the Project. It was also designed to:

- Avoid environmentally sensitive areas, where possible.
- Avoid areas which would represent restrictions to vessel movement e.g., anchorages, restricted navigation channels.
- Avoid areas of archaeological importance and wrecks.
- Avoid existing offshore infrastructure e.g., offshore wind farms, oil and gas infrastructure, marine aggregate extraction areas, aquaculture sites.
- Minimise the crossing of in-service cables and pipelines. Where it is not possible to avoid a crossing altogether, then to seek to optimise the crossing angle and to ensure that navigational safety or water depth is not adversely affected.
- Avoid hazardous seabed e.g., mobile sediments or bedrock outcrops and sub crops.
- Minimise any impact on third party considerations a such as seasonal fishing activities or local tourism.

Marine route alignments were developed in three distinct areas: England landfalls, an offshore section, and Scotland landfalls. The marine route options started at the English landfalls and merged to a common point approximately 100 km offshore. From the first common point in English waters, the offshore routes extended to another common point in Scottish waters before splitting into further options leading to the landfalls in Scotland. This led to two offshore marine route alignments being developed (Offshore Route 1 and Offshore Route 2) and one common offshore route alignment through the Firth of Forth. In English waters, six marine route alignments to English landfalls were developed from each Offshore Route. In Scottish waters, nine marine route alignments were developed to potential Scottish landfalls.

Each marine route alignment was assessed based on its own merits, technically and environmentally, taking into consideration any information available from other major developments in the region. They were also assessed in combination with the merits of the associated landfall and co-joining marine cable route alignments, to prove that the end-to-end solution meets the Project objectives.

An iterative, phased process was used to assess these marine route alignments which consisted of workshops (including input from technical and environmental disciplines from both the marine and terrestrial teams), key marine statutory stakeholders and industries consultation followed by either a second set of workshops or refinement of marine route alignments with further targeted stakeholder engagement and follow-up decision-making workshop. This process resulted in two phases of marine route alignments before the emerging preferred submarine cable corridor option was selected, which is presented in this Scoping Report.

Within English waters two options are presented in the Scoping Boundary; an option that avoids the Holderness Offshore Marine Conservation Zone (MCZ) but crosses the northern tip of the Silver Pit glacial tunnel valley feature outside of the site; and an option that crosses through the designated sites broadscale habitat features but avoids interaction with the Silver Pit glacial tunnel valley feature. A marine survey will be conducted on both route options to collect as much data on the designated site as possible in order to make an informed decision. The Joint Nature Conservation Committee (JNCC) and Natural England will be consulted, to inform the decision-making process and selection of the preferred option.

2.5.5. Alternative Construction Techniques

There are a variety of alternative construction techniques for power cables. The decision as to which combination of techniques to choose influences how the Project will affect the environment. Typically, the selection of alternatives will depend on the individual constraints and environmental conditions at any point along the proposed submarine cable corridor, meaning that different techniques may be appropriate at different locations. For example, surface cable lay with external cable protection may be necessary where ground conditions (e.g., outcropping bedrock) will not allow burial in the seabed, however burial in the seabed may be the most feasible solution for the remainder of the proposed submarine cable corridor.

Site-specific surveys would be carried out to inform engineering decisions and the selection of construction solutions. In the absence of detailed engineering, for the purposes of scoping it has been assumed that any construction technique could be used. The design parameters considered by this Scoping Report are presented in Section 3.

2.6. References

BEIS (2020) Energy White Paper: Powering our Net Zero Future. Available at: Energy White Paper (publishing.service.gov.uk)

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3. Project Description

3.1. Introduction

As described in Section 1.1 the Project comprises a 2 GW high voltage direct current (HVDC) system linking Fife in Scotland and Lincolnshire in England. The Project would include the construction of new infrastructure consisting of:

- **English Onshore Scheme:** An underground onshore HVDC cable system measuring approximately 100 km in length which connects the proposed landfall (at either Theddlethorpe Beach or Anderby Creek) within the vicinity of East Lindsey, Lincolnshire to a new converter station in the Walpole area of Norfolk. This proposed converter station will be connected to a substation near Walpole by underground high voltage alternating current (HVAC) cables, allowing the Project to connect to the existing English transmission system. A potential three-ended connection on the HVDC cable system to a Direct Current Switching Station (DCSS) and converter station located 11 km from the landfall is also being considered.
- **Marine Scheme:** Approximately 525 km of subsea HVDC cable from a proposed landfall at either Theddlethorpe or Anderby Creek, Lincolnshire to a proposed landfall at either Kinghorn or Lower Largo/Lundin Links, Fife. The submarine cable system will consist of two HVDC cables and a fibre optic cable for control and monitoring purposes.
- **Scottish Onshore Scheme**: A proposed converter station located in Westfield. From the proposed converter station there will be underground HVDC cable to a proposed landfall at either Kinghorn or Lower Largo/Lundin Links. The converter station will be connected to a substation by underground HVAC cables. The substation connects the Project to the existing Scottish transmission system.

This Scoping Report focuses on the Marine Scheme and the Project description therefore presents information on what the Marine scheme components will consist of, and how they will be constructed, operated and eventually decommissioned. The chapter provides a brief overview of the onshore components, where they are pertinent to the Marine Scheme.

Work has been undertaken to map the environmental and socio-economic baseline to gain a strong understanding of the constraints and features present in the Study Area which has informed the indicative project description presented in this Scoping Report. The design of the Marine Scheme will be developed in parallel to the Marine Environmental Assessment (MEA) process and will therefore evolve as the assessments progress. The design will be influenced by engineering, environmental and commercial factors, as well as consultation with local and national stakeholders. The final design envelope assessed for the Marine Scheme may still include some flexibility regarding design parameters but will clearly identify where construction techniques/methodology has been restricted to mitigate significant environmental concerns.

At the time of writing, the installation contractor has not been selected and detailed design work has not yet been completed. This chapter therefore provides an indicative overview of the anticipated submarine construction methods and intervention works. As the Project progresses, including the appointment of an installation contractor and as detailed engineering is carried out, some variation and more detailed design development will be conducted. In the meantime, and to ensure that the realistic worst-case scenario is considered in this Scoping Report, estimated design parameters presented here seek to reflect those options that may be anticipated to result in a 'worst case' environmental impact.

The Marine Scheme and proposed Scoping Boundary follows a broad south to north alignment from the proposed Landfalls in England toward the proposed Landfalls in Scotland. Distance along the proposed submarine cable corridor is indicated as KP (Kilometre Point) markers, with KP 0 defined from Anderby Creek at the southern Landfall. As there are still alternative Landfalls being considered, KPs have been created along the longest submarine cable corridor from the proposed English Landfall at Anderby Creek, around the Holderness Offshore Marine Conservation Zone (MCZ) to the proposed Scottish Landfall at Kinghorn. The KPs for this route are referenced as KP0 – KP524.9. Alternative options, which branch off this longest route, are: routed from the proposed English Landfall at Theddlethorpe to the point where it converges with the longest route (referenced as T_KP0 to T_KP14); through Holderness Offshore MCZ (referenced as H_KP0 to H_KP39); and from the proposed Scottish Landfall at Lower Largo/Lundin Links to the point where it converges with the longest route (referenced as L_KP_0 to L_KP_16).

3.2. Location of the Marine Scheme

The Marine Scheme comprises the components of the Project proposed from the Mean High-Water Springs (MHWS) mark at the proposed English Landfalls, Lincolnshire to the MHWS mark at the proposed Scottish Landfalls, Fife, through English and Scottish territorial waters and the UK Exclusive Economic Zone (EEZ).

The Scoping Boundary is illustrated in Section 1.4, Figure 1-2 (Drawing C01494--EGL4- LOC-012). The proposed submarine cable corridor extends for approximately 419 km in English waters and 106 km in Scottish waters.

The Scoping Boundary has been defined as the extent of the proposed submarine cable corridor, within which the cables will be laid and all marine works will be conducted. The Scoping Boundary is nominally 1 km wide, 500 m either side of the centreline, however, it widens in areas where there is still optionality in the design e.g., to allow for micro-routeing around potential seabed features. It is

anticipated that the marine licence application boundary will ultimately be 500 m wide following refinement and rationalisation as the MEA and design process evolves.

3.3. Components of the Marine Scheme

The Marine Scheme will comprise of two power cables and a fibre optic cable.

The detailed configuration of the cable system is still under development at this stage and will be informed by further electrical design studies and through selection of the cable supplier and installation contractor. However, in common with similar HVDC systems recently installed by the Applicants, it has been assumed that the HVDC link will comprise two single core metallic conductors (one positive, one negative) and a fibre optic cable. The cables will be installed either as a single bundle of two conductors and the fibre optic cable, or with the conductors laid separately in parallel, with the fibre optic cable bundled (i.e., secured) to one of the conductors. In the case that the conductors are laid separately, the separation between the conductors will be up to 30 m. Subject to detailed engineering and technical feasibility, the cable separation may be reduced to further limit the seabed footprint and electromagnetic field effects of the Project..

Burial depth is typically 1 - 2.5 m below chart datum. The final target burial depth will be determined by a cable burial risk assessment (CBRA) which will take into consideration location specific factors such as ground conditions (i.e., ability to bury), intensity of shipping and fishing activity. The results of the cable burial risk assessment will be used to inform the MEA.

The cables will likely be cross-linked polyethylene (XLPE) cable, which have been used in HVDC applications since 2000, and are proven to be reliable. As illustrated in Figure 3-1, the cables have a central core (comprising of aluminium or copper), protected by insulation and a lead sheath. Heavy steel wire is wound in a helical form around the cable as armour to protect the cable from external damage during construction and operation.

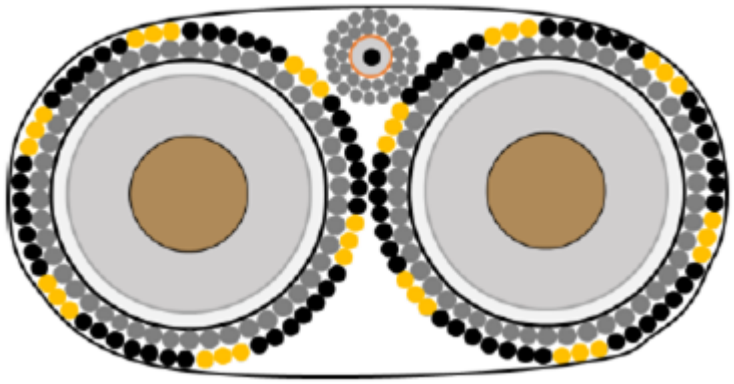

Figure 3-1: Example Illustration of bundled HVDC cable with fibre optic cable (illustration shows double wire armoured (DWA) sheathing and is indicative only)

The submarine cables will come onshore into a Transition Joint Bay (TJB) where they will connect with the onshore cables. The TJB is typically above the MHWS mark and therefore outside of the Marine Scheme. However, information on the landfall works is provided in the Project description for information purposes.

3.4. Pre-Construction Activities

Prior to the start of offshore cable installation, it is essential to ensure that the seabed is clear of obstructions that may hinder the construction works. Seabed preparation is expected to involve clearance activities to ensure the proposed submarine cable corridor is clear of boulders, dropped object debris, and other obstacles. Table 3-1 summarises the activities that may be expected to take place.

Table 3-1: Pre-construction activities

Activity	Description	Assessment Approach
Pre-construction survey	Seabed surveys would be carried out in the year prior to construction to reconfirm existing geotechnical and geophysical information about seabed conditions, bathymetry, and other seabed features. These may include Multi-Beam Echo Sounder (MBES); Side-Scan Sonar (SSS), Sub-Bottom Profiler (SBP), Magnetometer,	It is proposed that the pre-construction survey will not be included in the MEA process. In certain circumstances the Marine and Coastal Access Act 2009 (MCAA) provides for certain activities to be exempt from requiring a Marine Licence. The activities associated with the pre-construction survey would

Activity	Description	Assessment Approach
	cable trackers etc. In addition, visual inspections may also be undertaken using a Remotely Operated Vehicle (ROV) or other visual inspection system. Depending on the final Marine Licence Conditions, pre-construction surveys may also include additional specialist studies, including geotechnical, benthic, and Unexploded Ordnance (UXO) investigations.	qualify as exempt activities provided that the geotechnical and environmental sample sizes are <1 m^3 (individually) and the Applicant can demonstrate that the survey will not obstruct or present a danger to navigation and will not have a significant adverse effect on a marine protected area. To demonstrate that the proposed surveys qualify as an exempt activity Screening to Inform Appropriate Assessment (Stage 1 of the Habitats Regulation Assessment (HRA) process) and a European Protected Species (EPS) Risk Assessment would be prepared. These would be submitted with a Notifications of an Exempt Activity to the Competent Authority ahead of any survey works. Notices to Mariners would be published ahead of the survey commencing. Fisheries would be notified of impending survey activity through the Project Fisheries Liaison Officer (FLO). Appropriate consents would also be sought from The Crown Estate, Crown Estate Scotland, Natural England, NatureScot and the Port Authorities as relevant. Should ROV inspections be required the Applicant would liaise with the MMO regarding the requirement for licencing dependant on the activities that are being undertaken.
Unexploded Ordnance (UXO) Identification and Clearance	A UXO survey would be undertaken as part of the pre-construction surveys. The results of the survey will be used to identify potential UXO (pUXO). The Project would seek to avoid pUXO where at all possible through careful micro-routeing of the cables. If pUXO cannot be avoided, then further investigations would be undertaken to determine if the pUXO is an actual UXO or ferrous debris. Identification of UXO may involve further magnetometer and ROV investigations including small excavations. If a target is confirmed as a UXO, clearance activities may be undertaken e.g., removal to an alternate position on the seabed or removal for disposal on land. As a final option, in-situ detonation may be considered using either high or low order detonation.	As detailed above, the pre-construction survey will not be included in the MEA process. However, investigation of pUXO (Magnetometer, ROV and excavations) is a licensable activity and will be assessed as part of the MEA process. Should these investigations confirm the presence of UXO, a separate marine licence for clearance activities would be applied for, supported by the appropriate environmental assessments and if required underwater noise modelling. An initial UXO Desk-Based Assessment (DBA) has been undertaken, to determine the potential UXO risk, which has informed the position of the proposed submarine cable corridor. A more detailed UXO assessment would be undertaken to provide detail on potential UXO (age, type, size of explosive capability) that could be found in the proposed submarine cable corridor.
Seabed preparation	Prior to the start of offshore cable construction, it is essential to ensure the route is clear of obstructions that may hinder the construction works. These obstructions include boulders, out of service (OOS) third-party subsea assets and smaller debris such as fishnets, wires etc. The types of seabed preparation activity that may be required are: **Boulder Clearance** – Should boulder clearance be required, a plough would be towed across the seabed, pushing the boulders to both sides creating a cleared swathe 5-10 m wide with berms either side of the cleared swathe, width of the berms will be determined by	The Applicant intends to acquire geophysical, geotechnical, and environmental survey data along the proposed submarine cable corridor in 2023/2024. This data would be used in route engineering and design studies. Where possible, the route would be altered to minimise seabed preparation activities e.g., avoidance of sand waves or boulder fields. Where pre-sweeping is still required, studies would be undertaken to calculate the volume of sand to be

Activity	Description	Assessment Approach
	environmental conditions and the plough used. Alternatively, individual boulders would be moved to an alternative seabed position using a grab deployed from a vessel. **Pre-Lay Grapnel Run (PLGR)** – A PLGR is expected to be completed, involving towing a heavy grapnel with a series of specially designed hooks along the centre line of the route, snagging any debris on the seabed and within the top 0.5 m – 1.0 m of the seabed to confirm the construction site is clear of obstructions. Debris caught with the grapnel would be recovered to the vessel for appropriate licenced disposal ashore. **Pre-sweeping of sand waves** – To avoid potential future cable exposure, pre-sweeping may be required if areas of sand waves are identified within the proposed submarine cable corridor during the offshore surveys. Pre-sweeping may be performed using a variety of tools including dredgers, ploughs, or mass flow excavators (MFE). **Cutting Out of Service (OOS) Cables** – Removal of OOS cables may also be required; permission would be sought from asset owners to cut OOS cables crossed by the Project. The OOS cable would be snagged using a grapnel and then cut, with approximately a 100 m section of cable being removed from the seabed. The cut ends would be tied to a clump weight and placed on to the seabed. If the OOS cable is buried deeper than can be retrieved with the grapnel, then an ROV fitted with a dredger will be used to uncover the OOS cable. The OOS cable would then be cut using a hydraulic cutter fitted to the ROV. The removed cable will be recovered to deck and disposed of in line with a Waste Management Plan.	removed and identify suitable disposal locations that retain the sediment within the local sediment system. Consultation with relevant authorities would be undertaken to determine the most suitable methods for the pre-sweeping noting sensitivities in Scottish waters. Sediment samples will be analysed by a MMO validated lab in line with MMO/MD-LOT requirements. Consultation would be undertaken with Fisheries Associations with respect to the location of OOS assets and how these interact with specific fishing grounds, so that mitigation can be identified if necessary.
Third-party asset crossings – preparation	Where the Project crosses live infrastructure e.g., cables and pipelines, the Applicants will enter discussions with the asset owner to agree how the crossing of the asset should be engineered. These agreements detail the physical design of the crossing and outline the rights and responsibilities of both parties to ensure ongoing integrity of the assets. Vertical separation between the Project cables and third-party assets would be achieved through either placing rock on the crossing locations prior to offshore cable installation, or through the placement of concrete mattresses at the crossing location to create the required separation distance. To protect the third-party assets during cable installation minimum standoff distances for equipment (PLGR, burial tools etc) would be agreed with the asset owner.	The MEA would identify all crossings and provide indicative crossing dimensions. Consultation would be undertaken with Fisheries Associations with respect to the locations of crossings to identify what location specific mitigation may be technically feasible.

3.5. Construction

3.5.1. Landfall

The English landfall is the interface between the Marine Scheme and the English Onshore Scheme. The approximate location for the proposed Landfall area is along the Lincolnshire coast at either Theddlethorpe or Anderby Creek, as shown in Figure 1-2 (Drawing C01494-EGL4-LOC-012).

The Scottish Landfall is the interface between the Scottish Onshore Scheme and the Marine Scheme. The proposed locations for the Scottish Landfall still under consideration are at Kinghorn, south of Kirkcaldy, and at Lundin Links golf course in Lower Largo as shown in Figure 1-2 (Drawing C01494-EGL4-LOC-012).

The alignment of the cables through the intertidal zone will be informed by considerations of technical, environmental, and other relevant criteria as well as the outputs from technical and engineering studies. The cable alignment across the proposed landfall will also be dependent on the chosen alignment for the onshore infrastructure. As with the marine scheme, this will be informed by a range of technical and environmental factors.

At the time of writing, a decision between a trenchless construction technique (Option 1) beneath the beach and adjacent environmental sensitivities and an 'open cut' trenching method (Option 2) across the soft sediment beach has not yet been made. Where possible the trenchless solution would be the Applicants' preference, but its selection is dependent on technical and engineering studies. Consequently, this Scoping Report considers basic design principles for both options at this stage. It is understood that the preference of the Statutory Nature Conservation Bodies is for a trenchless construction technique. Table 3-2 describes the activities that could be undertaken at each proposed Landfall and how they will be assessed.

Table 3-2: Landfall construction activities

Activity	Description	Assessment Approach
Trenchless construction	Trenchless construction techniques include horizontal directional drilling (HDD), micro-tunnelling and using a direct pipe. These are techniques commonly used to install cable duct(s) underneath sensitive environmental features (such as sea defences, dune system, etc) or technical constraints (cliffs, shallow bedrock etc.). The information contained within this Scoping Report only relates to the typical approach for a HDD installation. Subject to the size of the duct(s) required and the ground conditions expected to be encountered, the operation typical comprise the initial drilling of a small diameter pilot hole which is then increased in stages (known as the "reaming" stage), followed by the installation of a cable duct. Drilling will use bentonite clay and water as a drilling fluid. It is expected that up to three HDD cable ducts would be installed (one for each cable), although solutions to reduce this are being investigated. It is currently assumed that the length of each duct will likely extend from a compound location above MHWS to a punch-out point below MLWS, indicatively 1.6 km. The punch-out points would be defined by the geological suitability of the seabed and metocean conditions. The punch-out point may need to be excavated and would be left to either naturally back fill or would be manually infilled with excavated material. A temporary compound would be required landward of the intertidal zone. It is anticipated that this compound would contain the TJB and would be situated as close as is technically feasible above MHWS, based on the geological and geotechnical suitability of the ground and also considering coastal erosion and sea level change over the asset lifespan. The size and location of a compound has not yet been confirmed; however, this is part of the onshore scheme, and therefore out of the scope of this report.	The Applicant intends to acquire geophysical, geotechnical and environmental survey data at the proposed Landfall and in the nearshore in 2023/2024. This data would be used to inform detailed engineering work to ascertain the trajectory, target depth and length of the trenchless construction solution.
Open-cut trenching	This construction methodology comprises the excavation of trenches across the intertidal zone perpendicular to the water line using conventional land-based excavators. Typically, this is undertaken whilst the tide is low but can also be supported by barge mounted excavators below MLWS. A trench would be formed, the dimensions of which are yet to be determined following the completion of site-specific surveys and will be to sediment conditions, would be formed. Access to the construction site would be gained across the soft sediment beach	All potential construction methodologies will be assessed to identify any that should be excluded due to the potential for significant impacts, and whether mitigation is required.

Activity	Description	Assessment Approach
	via a corridor which would be up to 10 m wide. Following the formation of the trench, the cables would either be pulled directly ashore using rollers, or ducts and messenger wires installed to facilitate cable pull-in at a later date, subject to detailed engineering. It is expected that a maximum of two open-cut trenches would be excavated through the intertidal zone. Once the cable or ducts are installed these trenches will be backfilled. It is possible that this option would require a cofferdam. A cofferdam is typically a sheet-piled structure which can be used within the marine environment to create a safe, dry working area. If a cofferdam is required, it is expected that vibratory piling would be adopted for installation of sheet walls with percussive piling only used where required to achieve design depth.	

3.5.2. Submarine Cables

Table 3-3 describes the construction activities associated with the installation of the submarine cables and the assessment approach to be taken. The submarine cables will be buried into the seabed wherever feasible. However, there may be some areas where ground conditions (e.g., sub cropping/outcropping rock), or the presence of third-party assets (existing cables or pipelines) would mean that the submarine cables are surface laid requiring external protection. Table 3-4 presents the maximum key design parameters, representing worst case for assessment.

Table 3-3: Submarine cables construction activities

Activity	Description	Assessment Approach
Cable lay and burial	There are three possible configurations for cable installation and protection: pre-cut trenching and cable lay; Simultaneous Lay and Burial (SLB); and cable lay and post-lay burial. One or a combination of these would be used, depending on the ground conditions, environmental constraints and installation contractor selected. Cable lay and installation operations would be performed on a 24-hour basis, to minimise construction time and the duration of any disruption to sensitive environmental receptors as well as navigation and other sea users; this would also maximise available weather opportunities, as well as vessel and equipment availability. "Guard vessels" may be on site to warn mariners of any lengths of unprotected cable. As per industry best practice, the preferred submarine cable protection method is burial. It is not yet confirmed what subsea trenching equipment would be used to install the cables; however, it is anticipated that the following may be required dependent on the seabed conditions present within the proposed submarine cable corridor: • Jet-trenching – positioned on the seabed, a jet trencher uses a powerful water jetting tool to fluidise the seabed allowing pre-laid cables to sink to the required burial depth. The cable trench is typically left to back-fill naturally or would be manually infilled with excavated material. • Conventional narrow share cable plough – as the plough is pulled through the seabed it cuts and lifts a wedge of soil. The cable is then fed into the plough and guided down through the share to the base of the trench and the soil wedge is placed back in over the cable. For this option, the seabed level tends to recover to its natural state within several tidal cycles. • Advanced cable ploughs (vertical injectors) – deep burial ploughs using water jets fitted within the plough share to fluidise material at	The Applicant intends to acquire geophysical, geotechnical, and environmental survey data, including vessel and fishing activity, along the proposed submarine cable corridor in 2023/2024. The data would inform a CBRA which would define the minimum depth that the cables must be buried to protect them from external influences (e.g., dropped anchors, fishing gear interaction). The data would also be used to identify which cable burial tools may be selected. All potential construction methodologies would be assessed to identify if any should be excluded due to the potential for significant impacts, and whether mitigation is required.

Activity	Description	Assessment Approach
	the leading edge of the share. Can achieve deeper burial depths (i.e., 3-6 m). The cable trench would be left to back-fill naturally. • Cutting – used in hard sediments such as clay and weak bedrock or gravelly sediments to pre-cut a trench. The cables are then laid within the trench, and burial achieved either via back-fill plough or mass flow excavator. • Mass Flow Excavation (MFE) – suspended above the seabed a MFE uses high pressure water jets to fluidise the seabed which allows the cable to sink to the required burial depth. The cable trench would be left to back-fill naturally. The depth to which the cables would be buried will be dependent on a combination of seabed conditions and the perceived risk and probability of potential hazards to the cables and other users of the sea (e.g., vessel traffic, anchoring activity, and demersal fishing activity). A CBRA will be conducted to inform burial depth requirements; however, it is currently anticipated that the burial depth would be 1 - 2.5 m.	
External cable protection	As detailed above, burial of cables is the preferred method of protection and any requirement for additional external protection would be considered a last resort and minimised by micro-routeing, refinement of target burial depths, selection of appropriate burial tools and remedial trenching. However, there may be areas within the proposed submarine cable corridor where adequate protection of the cables cannot be achieved through burial and additional external protection is required, for example where there is insufficient sediment cover, boulders, or crossings of existing seabed assets. Options for providing external protection include: • Rock placement – this involves the construction of a continuous, profiled berm of graded rock over the cables. It may be used along sections of the cables where seabed conditions do not allow sufficient protection by burial (either planned or remedial), at crossings and joint locations, and where the cables transitions from surface lay to burial such as HDD punch-out points. Rock berms would be installed using targeted placement methods, e.g., fall pipe vessels would be used rather than using side or bottom discharge vessels. • Concrete mattresses/Concrete half shells – Concrete mattresses are frequently used to protect submarine cables and can also be used to construct crossings over existing submarine cables and pipelines. They are flexible and thus follow the contours of the seabed or crossed assets. Concrete half shells are newer innovations in the industry which form a barrier over surface laid cables to protect from dropped objects. • Sand/Grout/Rock bags – smaller bags filled with either sand, grout (which sets in water to the profiled shape), or rock bags can also be used to provide very localised protection, where most mechanical means such as trenchers cannot reach, such as HDD punch-out locations. • Imported sand placement – following cable installation in the trench, should insufficient sediment be present to re-bury the cables the trench may be backfilled with sand from a licensed marine extraction site. • Tubular protection systems - additional protection can be provided around the cable in the form of articulated half shells. They are	The deposit of substances on the seabed within the UK Marine Area is a Licensable Activity under the MCAA. In the Scottish marine area this activity is licensed under the Marine (Scotland) Act 2010. Data acquired during the proposed submarine cable corridor survey would be used by engineering studies to determine locations along the proposed submarine cable corridor where ground conditions may prevent burial to the required depth of lowering. A precautionary approach will be taken in the MEA with indicative locations identified and assessed.

Activity	Description	Assessment Approach
	generally made of either high density polyurethane (HDPE) or cast-iron. The potential requirement for additional external cable protection would be confirmed through further design development, both pre- and post-consent and would be informed by offshore survey information as it becomes available. Where external protection is or may be required, details of the type, quantity and nature of each protection measure would be provided in the MEAp and used to inform the MEA including, estimated locations, volumes/numbers, tonnages, and likely grades of rock or other materials to be used. This would include both planned and potential remedial requirements and would be provided to characterise the nature and extent of cable protection which may be installed within English and Scottish territorial and offshore waters.	

Table 3-4: Subsea cable design parameters

Parameter	Design Envelope
Cable construction	
Number of trenches	2
Maximum separation distance between trenches	30 m
Anticipated maximum burial depth (below mudline)	2.5 m
Maximum installation tool seabed disturbance width	20 m
Maximum width of cable trench	1 m
Maximum width of external cable protection	15 m

3.5.3. Construction Vessels

A range of different vessels will be required during construction. These are likely to include:

- Cable Lay Vessel (CLV): The CLV would be a specialist ship designed to carry and handle long lengths of heavy power cables. The CLV would be equipped with a dynamic positioning (DP) system. The shallowest depth in which the cable ship can operate will depend on the vessel used but is typically around 10 m lowest astronomical tide (LAT), although some vessels can operate in much shallower depths.
- Cable Lay Barge (CLB): Alternatively, a CLB may be required at the proposed Landfall(s). These types of vessels typically operate in water depths less than 10 m LAT. A CLB would require a four to six-point anchor mooring system covering an area of between 500 m and 1,000 m radius from the vessel to allow the barge to hold station whilst the construction work is undertaken.
- Jack-up/anchored barge or vessel/multi-cat: These types of vessels may be used at the trenchless technique punch-out point to support the drilling and pull-in of the cables.
- Small work boats: smaller work boats may be required to support the main construction vessels. Examples include anchor handling vessels, tugs, Rigid Inflatable Boats (RIBs).
- Construction Support Vessels (CSVs): CSV include a variety of vessels that may be required to support construction activities. This may include survey vessels, diver support vessels, and general construction support vessels. CSVs come in a variety of sizes and are adapted to undertake different roles, for example archaeological or UXO inspection, PLGR, OOS cable removal, placement of concrete mattresses etc.
- Rock placement vessels: A rock placement vessel features a large hopper (tank) to transport rock and a mechanism for deploying rock on the seabed. There are many different types of rock placement vessel, however for the purposes of this Scoping Report, it has been assumed that a flexible fall pipe mechanism for rock placement would be used whereby a retractable chute is used to control. The flow of rock to the seabed.
- Guard vessel: guard vessels are used to ensure the safety of mariners operating in the vicinity of construction and maintenance activities associated with the cable. They may be required to accompany the CLV, particularly in areas of

high-frequency shipping. guard vessels are also used to protect areas of exposed cables prior to burial or deposit of external cable protection.

For the purposes of the Scoping Report, it has been assumed that during cable installation, a 'rolling' 500 m safety zone would be applied around construction vessels and activities.

3.6. Operation, Maintenance and Repair

Once buried, submarine cables do not require routine maintenance. However, it is likely that regular inspection surveys would be undertaken using standard geophysical survey equipment and/or ROV to monitor the cables' burial depth and the condition of any external protection. Maintenance activities may be required, subject to the results of the inspection surveys, to ensure the integrity of the cable is maintained. These may take the form of remedial trenching or deposit of additional external protection. For example, maintenance works may be required to re-bury any sections of cable that have become exposed and or to reinstate rock berms that may have become displaced.

The most common reason for repair of a submarine cable is damage caused by third parties, typically caused by trawlers or commercial ships' anchors on a shallow or exposed cable segment. A repair requires removal of the damaged section of cable, insertion of an additional cable section 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. 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 or hairpin. This would then be buried into the seabed, or external cable protection would be deposited if burial is not feasible due to ground conditions or position. Depending on the size of the repair and location, a construction vessel may be stationary at a location for 1-2 weeks at a time.

The requirement for repair operations during the lifetime of the Project would depend on the number of faults, location of the faults, and the burial/protection method used for the original installation. When assessing the impacts of a repair operation within the MEA, feasible worst-case scenarios will be assessed. Information on seabed characteristics would be used to identify any locations along the proposed submarine cable corridor where burial might not be feasible following a repair, and external cable protection therefore might be required.

3.7. Decommissioning

The life expectancy of the submarine cables is 40 years, although with repairs, some cable systems last upwards of 60 years. The proposed Marine Scheme (within territorial waters) would be the subject of a Licence or Lease from the Crown Estate and Crown Estate Scotland. An Initial Decommissioning Plan would be written once the final route and construction methodology is chosen. This is a legal requirement necessary to secure the Crown Estate and Crown Estate Scotland Licences. The Initial Decommissioning Plan (IDP) would form the basis of the Final Decommissioning Plan which would be developed in consultation with The Crown Estate and Crown Estate Scotland. The measures and methods for any decommissioning would comply with any legal obligations which would apply to the decommissioning of the cable when it takes place. The IDP is periodically reviewed and updated in line with the applicable guidance and regulations at the time.

The environmental impact of decommissioning the Project would be assessed at the time of decommissioning. Removal of the cable is a similar process to the construction 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. However, the MEA will considering the potential impacts of decommissioning as a high level in line with The Crown Estate and Crown Estate Scotland decommissioning principles.

3.8. Environmental Management

Prior to construction commencing, the Applicant would be required to prepare a Construction Environmental Management Plan (CEMP) and associated implementing procedures. The CEMP is a tool that sets out the Project's commitment and approach to environmental management and will ensure that all and any Contractors (including sub-contractors) engaged during the pre-construction and construction phase of the Project are advised of the responsibilities for environmental protection.

The objectives of the CEMP are to:

- Outline the applicable legislation, guidelines, licences, and permissions associated with the works.
- Highlight the mitigation identified prior to award of the licences and permissions.
- Provide the overarching framework for environmental management, highlighting the hierarchy of documentation that will be used to manage environmental impacts during the offshore construction works.
- Provide details of responsibilities in relation to environmental management, including induction training.

- Detail how environmental compliance will be audited and reported, and any non-conformance will be managed and corrected.
- Ensure consistency in approach and performance of environmental management across the Engineering, Procurement, and Construction (EPC) Contractor and its sub-contractors during the offshore construction works.

3.8.1. Net Zero Targets

In the UK, NGET has set a target to achieve carbon neutral construction by 2026 on all projects, while SPEN are committed to achieving carbon neutral electricity generation, distribution and consumption target by 2030 as well as reaching net zero emissions on all company activities by 2040. The Electricity System Operator has also committed to be able to fully operate Great Britain's electricity system with zero-carbon by 2025. These commitments are relevant to the delivery and operation of the Project.

Furthermore, the Project will itself help the UK deliver on its target of becoming net-zero in all greenhouse gases by 2050 for England and Wales and 2045 for Scotland, as it will help facilitate the transmission of electricity generated from a variety of renewable sources around the UK.

3.9. Indicative Programme

The timescales for the key stages of the Project are outlined in Table 3-5.

Table 3-5: Indicative project schedule

Stage of development	Time period
Consultation on Scoping Report	Q1 2024
Proposed marine characterisation surveys (Geophysical, Benthic and Geotechnical)	Q3 2023 – Q3 2024
Preparation of engineering and environmental studies and assessments	2024
Pre-application consultation with stakeholders	Q2 2023 – Q3/Q4 2024
Submission of Marine Licence application	Q2 2025
Determination of Marine Licence application	Q2 2026
Construction	From 2027
Operation	2030/2031

* Calendar years

4. Marine Environmental Assessment Approach and Methodology

4.1. Introduction

This section describes the approach to the Marine Environmental Appraisal (MEAp) that will be prepared to support the Marine Licence applications for the Project. The MEAp will report on the approach taken, and the findings and conclusions of the wider Marine Environmental Assessment (MEA) process. It will also set out the mitigation measures proposed to avoid or reduce the significance of effects to an acceptable level. This section describes the stages taken in the MEA process (screening, scoping and assessment), and the approach and criteria to be used during the assessment stage. It also explains the purpose of, and proposed approach to the MEA, to cumulative and in-combination effects, as well as mitigation and monitoring.

This chapter sets out common matters that are relevant to all technical chapters of this Scoping Report and should therefore be read in conjunction with those chapters. Where known at this stage, any proposed divergence from the standard methodology set out below is explored within the technical chapters themselves.

This Scoping Report has been produced to cover both jurisdictions and a similar approach to the MEAp is proposed. However, the Applicants would appreciate feedback on whether there is a preference from the MMO and MD-LOT as to whether a single MEAp is produced to accompany the marine licence applications or whether separate MEAps would be more appropriate.

At this early phase, the project description is indicative and has been developed to include sufficient flexibility to accommodate further refinement during detailed design. Chapter 3 (of this Scoping Report) sets out a series of options and/or parameters for which maximum values are used to inform the MEA for the Project.

The purpose of the MEA is to provide a systematic analysis of the impacts of the Project in relation to the existing (baseline) environment. This is summarised in an MEAp, which provides information to the Regulatory Authority (in this case the MMO for the components of the Project in English waters and MD-LOT for the components of the Project in Scottish waters), statutory consultees, stakeholders and the public, to enable them to assess the acceptability of the Project and its potential environmental effect.

The MEA will address the three phases of the Project:

- Construction – the works, activities and processes that will be required to build the Project, including preparatory works.
- Operation and Maintenance (O&M) – the works undertaken during the lifetime of the Project, after construction works are completed, during operation of the HVDC link.
- Decommissioning – the works and processes required to undertake the closure, dismantling and removal of the Project.

The MEA process typically comprises a series of phases, which are shown in Figure 4-1 and Table 4-1. Although a statutory EIA is not required for the Project, the MEA process will be undertaken to the same standard, and will include:

- A description of the Project comprising information on the site, design and size of the development.
- A description of the aspects of the environment likely to be significantly affected by the development.
- The likely significant effects of the Project on the environment.
- Mitigation measures required to minimise potentially significant effects.

The technical topic areas identified for assessment as part of the MEA for the Project are:

- Marine Physical Processes (including metocean conditions, coastal and seabed geomorphology, and sediment and water)
- Designated Sites and Species
- Intertidal and Subtidal Benthic Ecology
- Fish and Shellfish Ecology
- Intertidal and Offshore Ornithology
- Marine Mammals and Marine Reptiles
- Shipping and Navigation
- Commercial Fisheries
- Marine Archaeology
- Other Marine Users and Activities (including tourism)

Figure 4-1 presents an overview of the proposed MEA approach, which is described in more detail in the following sections. Relevant stakeholders will be engaged at various stages throughout the MEA process.

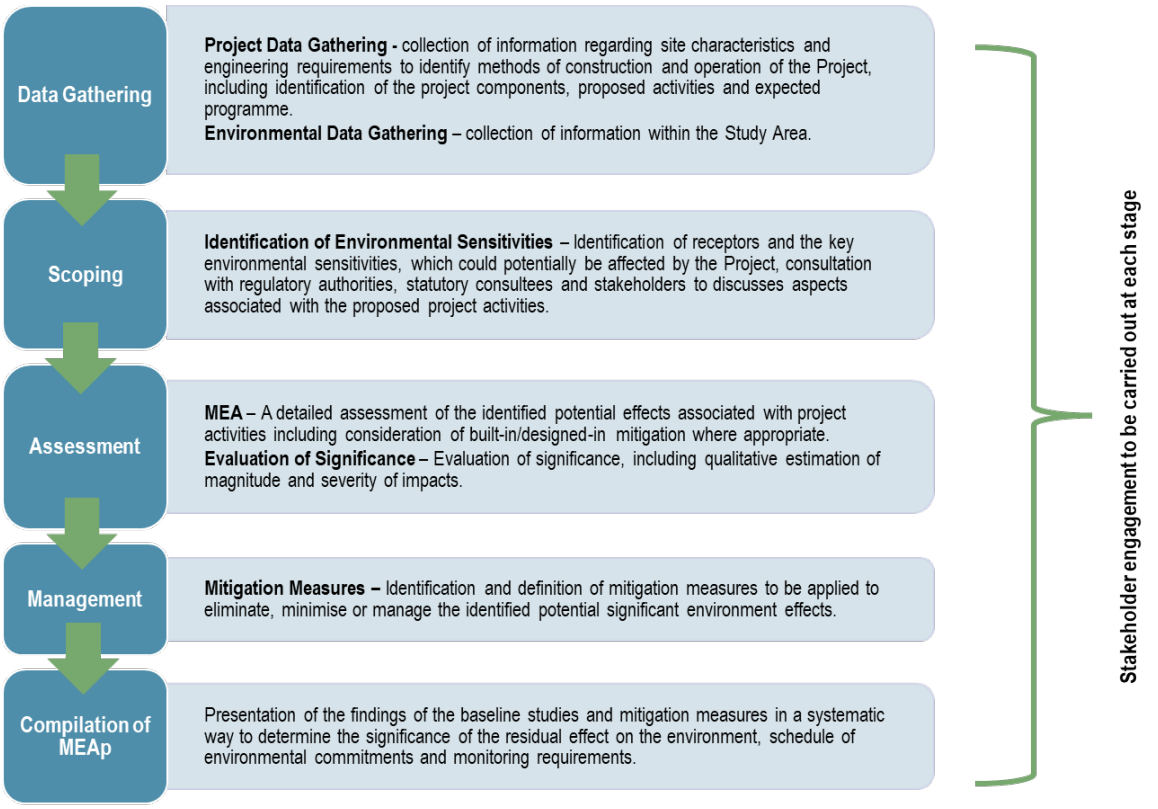

Figure 4-1: Overview of the MEA approach

4.2. Guidance and Best Practice

Although the Project does not require a statutory EIA, the approach to the MEA and the production of the MEAp will closely follow numerous relevant EIA guidance and industry best practice documents, including but not limited to:

- National Infrastructure Planning advice notes - insofar as the principles for good EIA practice, and approaches to related assessments (such as cumulative, transboundary, and in-combination effects) may be considered appropriate.
- Relevant guidance issued by other government and non-governmental organisations (e.g., licensing and EIA guidance published by JNCC, MMO, MD-LOT and NatureScot).
- Professional EIA guidance documents:
  - Guide to Shaping Quality Development (IEMA 2016)
  - Delivering Proportionate EIA, A Collaborative Strategy for Enhancing UK Environmental Impact Assessment Practice (IEMA 2017)
- Best Practice guidance documents informing assessment:
  - Natural England Offshore wind cabling: ten years' experience and recommendations (NE 2018)
  - Review of cable installation, protection, mitigation and habitat recoverability (RPS 2019)
  - Receptor specific guidance as outlined in individual topic chapters.

4.3. Data Gathering

Data gathering for the Project has already commenced. Environmental information has been collected from publicly available data sources and will be supplemented with information as agreed with relevant consultees during the Scoping and MEA process. Site-specific baseline surveys will be undertaken to fill gaps in the available data.

The environmental characterisation survey detail will be covered in the receptor topic sections of this Scoping Report. The specific approach to establishing a robust baseline (upon which effects can be assessed) is set out under each parameter within this Scoping Report. It is envisaged that this approach will be subject to review following the receipt of the Scoping Opinion from the MMO and MD-LOT and subsequent consultation with statutory bodies. It is also recognised that this approach may evolve over time with the collection of new data from the Study Area and as the design of the Project advances.

The relevant data currently available and a gap analysis are provided in each technical chapter of this Scoping Report.

4.4. Approach

The MEA will be undertaken within a consistent framework that will facilitate transparency in the assessment and its conclusions. The definition of terms and assessment processes that will be adopted by each of the specialist assessors is described below.

In general, the MEA will identify, describe and analyse the potential effects of the Project using a source-pathway-receptor model. For instance, a project activity (source) may entail a predicted change in environmental conditions affecting either directly or indirectly (the pathway) a specific component of the baseline environment (the receptor). If the receptor is sensitive to the change it could result in either a positive or negative impact/effect. Figure 4-2 presents this model with a specific example to illustrate the concept.

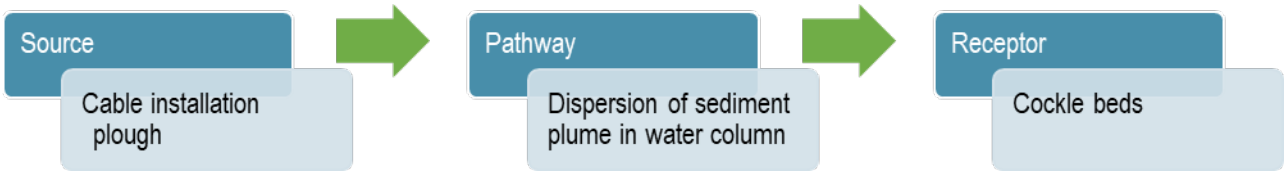

Figure 4-2: Source - Pathway - Receptor model example

Confusion can arise whilst reading an MEAp due to a lack of clarification around the words 'impact' and 'effect'. Throughout the assessment process, the term 'impact' will be used to define a change that is caused by a source. For example, pile driving of foundations during construction (the source) results in increased levels of subsea noise (the impact). Impacts can be direct, indirect, secondary, cumulative, inter-related or transboundary. They can also be beneficial, adverse or negligible. The term 'effect' will be used throughout the assessment (and in the MEAp) to express the outcome of an impact, i.e., the increased levels of suspended sediment (impact) from the laying of the cable (source) has the potential to smother benthic communities or fish habitat (the effect).

The MEA process will following a sequential process as described in Table 4-1 and further outlined in Sections 4.4.1 to 4.4.5. Consultation with statutory and non-statutory stakeholders is an ongoing process that was started during the feasibility stage of the Project (i.e., to inform route development and option appraisal) and will continue throughout the assessment process. Consultation will inform each of the steps outlined in Table 4-1 and is described in further detail in Section 4.8.

Table 4-1: Assessment methodology

Step		Description
1	Characterise the baseline environment	Uses publicly available information and where necessary site-specific survey to identify sensitive receptors.
2	Establish the potential impacts to be assessed	Impacts are the mechanism by which the licensable activity could influence or have a marked effect on a receptor. The nature of an impact is determined by the activity type, intensity and duration.
3	Evaluate the significance of the impact	The significance of an impact on a receptor is characterised by the sensitivity of the receptor to the impact (considering its recoverability and importance) and the magnitude of the predicted impact i.e., the duration, frequency, spatial extent and scale of change from the baseline that is predicted to occur. Combined, the sensitivity of the receptor and the magnitude of the impact are used to determine the significance of the impact.
4	Establish mitigation (where required)	Impacts which are Minor or Negligible (Not Significant) typically do not require mitigation measures other than compliance with environmental legislation and best practice. Impacts which are classified as Moderate or Major (Significant) would typically be unacceptable without the implementation of project specific mitigation designed to avoid or abate the significance of the impact. When identifying mitigation, a standard hierarchical approach has been taken as follows: 1. Avoid or prevent: Preferably the mitigation should seek to avoid or prevent the significant impact at source e.g., by avoiding the sensitive receptor spatially or temporally. 2. Reduce: If the impact is unavoidable the mitigation measures which seek to reduce the significance of the impact e.g., by reducing the footprint, duration or intensity. 3. Offset: If the impact can neither be avoided nor reduced then mitigation measures should seek to offset the effect through the implementation of compensatory measures. The MEAp will identify appropriate and feasible mitigation measures to be implemented to ensure compliance with environmental legislation and best practice and reduce environmental impacts.

It should be noted that where a receptor is a Primary Feature or Qualifying Feature of a European Site (e.g., SAC or SPA) or a Protected Feature of a Marine Conservation Zone (MCZ) or Marine Protected Area (MPA), the MEAp will reference the conclusion of the information provided by the Applicant to support either the Habitats Regulations Assessment (HRA) process or the Marine Conservation Zone Assessment process (further described in Section 5).

4.4.1. Characterise the Baseline Environment

An evidence-based approach will be used throughout the assessment. This involves not only utilising data collected specifically for the purposes of the Project, but also data and information from sufficiently similar projects or activities to inform the understanding of the baseline or the significance of the effect.

The Project neighbours several developments, including offshore wind farms, marine aggregates areas, and other power cable or telecommunication cable projects and pipelines. Therefore, extensive data from the Marine Licensing, Environmental Statements and baseline and post-construction monitoring data are available which provide both raw data and modelling that will inform the assessments for the Project. Where possible, appropriate, and agreed with the relevant stakeholders, the Applicant intends to use this existing data to:

- Aid in the characterisation of the baseline environment, where data is sufficient and appropriate to do so.
- Scope out impacts where there is a clear evidence base.
- Provide evidence for assessments where impacts are scoped in.

The use of this existing data is encouraged as part of several analogous industries and has for example been included in the offshore wind industry's response to Government drivers to reduce the cost of offshore wind energy. Collaborative Offshore Wind Research into the Environment has provided best practice principles for documentation and dissemination of data (COWRIE, 2008a).

Each topic chapter will identify where the data used for the baseline and the impact assessment will be sourced from. A gap analysis has been undertaken to identify the requirement for additional data to be collected.

Each topic chapter provides the methodology for any new data collection (if required) including surveys. Adequate data collection will be undertaken for the purposes of the assessment, to enable the receiving environment to be robustly characterised.

This Scoping Report sets out to provide a detailed justification that is anticipated to facilitate the scoping out of certain topics or impacts from further assessment.

Mitigation that is embedded (designed-in) within the Project will be described in the MEAp. Any modification of the standard approach and definitions will be fully described and justified within each section where necessary.

4.4.2. Establishing the Impacts to be Assessed

Impacts will be established by the project team based on industry experience and consultation with relevant stakeholders. Where applicable, the list of marine pressures established by the Joint Nature Conservation Committee (JNCC) Marine Pressures-Activities Database v1.5 (2022), Natural England's and NatureScot's advice on operations for relevant European sites will be used to establish impacts to be assessed. These lists do not include impacts on social or human receptors.

For each impact the zone of influence – the spatial extent over which the pathway could affect the receptor – will be established. This will be undertaken quantitatively where possible, or qualitatively based on evidence from analogous projects, post-construction monitoring data and literature reviews.

Receptors which occur outside of the zone of influence, and which cannot, or are unlikely to, travel into the zone of influence, will be scoped out. Conversely, mobile receptors which could travel into the zone of influence will be scoped in. Where the zone of influence is currently uncertain, the Scoping Report identifies what surveys, studies and/or assessments will be undertaken to define it and taking the precautionary approach impacts will be scoped in until they can be fully defined.

Where several activities (sources) result in the same impact, or the construction technique has not been determined, the maximum spatial extent will be assumed.

4.4.3. Assessment of Effects

Effects will be presented within the MEAp as 'significance of effect', which will take into account the magnitude of an impact in combination with the importance and/ or the sensitivity of the receptor or resource, in line with defined significance criteria.

The assessment process will consider the following:

- The magnitude of the impact.

- The sensitivity of the receptor to the impact.
- The probability that the impact will result in a given effect.
- The significance of the resulting likely environmental effect.
- The level of certainty inherent within the assessment.

4.4.3.1. The Magnitude of Impact

The magnitude of an impact provides a useful initial measure of the likelihood of an environmental effect arising. Magnitude is defined for the purposes of assessment via four factors:

- Extent – The area over which an impact occurs.
- Duration – The time for which the impact occurs.
- Frequency – How often the impact occurs.
- Severity – The degree of change relative to the baseline level.

The assessment will use the criteria established in Table 4-2.

Table 4-2: Criteria for characterising the magnitude of an impact

Magnitude	Definitions	
	Physical/Biological	Socio-Economic
High	Impacts are of long-term (>15 years) through to long-term/permanent duration and/or on a regional or population/habitat level or major alteration to key elements/features of the baseline condition such that post-impact baseline character will be fundamentally changed. Natural recruitment will not return the population/habitat to the baseline condition.	Total loss of, or major alteration to key elements or features of the pre-project conditions, such that the post-project character or composition of the feature would be fundamentally changed.
Medium	Impacts are of medium term (7-15 years) duration and/or on a local level (wider than project footprint) or alter an element of the baseline conditions such as that post-impact the damage to the baseline is above that experienced under natural conditions but with no permanent effect on integrity.	Loss of or alteration to key elements or features of the pre-project conditions, such that the post-project character of the feature would be partially changed.
Low	Impacts are temporary (<1 year) or short term (1-7 years) in duration, site specific and/or a minor shift away from the baseline condition such as that experienced under natural conditions. Impacts limited to within the Project footprint. Negligible contribution to cumulative effects.	Minor alteration from pre-project conditions.
Negligible	Very little or no detectable change from baseline conditions. Disturbance is within the range of natural variability. Impacts predicted to be brief (one to two days) or for a short period (up to 3 months). No contribution to cumulative effects.	No or unquantifiable change to pre-project conditions.

4.4.3.2. Sensitivity to the Impact

The criteria provided in Table 4-3 will be used to characterise the sensitivity of the receptor and the magnitude of the impact. The sensitivity of the receptor is a function of its capacity to accommodate change and reflects its ability to recover if it is affected. The sensitivity of the receptor is therefore quantified via the following factors:

- Value - A measure of the receptor's importance, rarity and worth.
- Adaptability - The degree to which a receptor can avoid or adapt to an impact.
- Tolerance - The ability of a receptor to accommodate temporary or permanent change without a significant adverse impact.
- Recoverability - The temporal scale over and extent to which a receptor will recover following an impact.

The assessment will use the criteria established in Table 4-3. If the approach differs for a specific receptor, the criteria used will be outlined in the topic chapter. An example of this are heritage assets. The National Planning Policy Framework (NPPF) (MHCLG, 2021) states that heritage assets should be recognised as “an irreplaceable resource” and to “conserve them in a manner appropriate

to their significance". Archaeological receptors cannot typically adapt, tolerate or recover from physical impacts resulting in material damage or loss caused by development. Consequently, the sensitivity of each receptor is predominantly quantified only by their value. Where receptors are considered to be capable of adapting to, tolerating or recovering from indirect impacts, these factors were incorporated into an assessment of their sensitivity.

Table 4-3: Criteria for characterising the sensitivity of receptors

Sensitivity	Definitions		
	Physical	Biological	Socio-Economic
High	Receptor has low/no capacity to return to pre-impact conditions i.e., recovery will take longer than 10 years. The physical/or geological features are protected feature of an internationally designated site (e.g., SAC).	Receptor has low tolerance to change i.e., recovery will take longer than 10 years following the cessation of activity or will not occur. The receptor is a protected feature of an internationally designated site (e.g., SAC, SPA) and the licensable activity is taking place during a sensitive season.	Receptor is economically valuable and has low/no capacity to return to pre-impact conditions, e.g., low tolerance to change and low recoverability such as loss of access with no alternatives or the impact will have major financial consequences for the receptor.
Medium	Receptor has intermediate capacity to return to pre-impact conditions i.e., between 5 to 10 years. The physical/or geological features are protected feature of a nationally designated site (e.g., MCZ, SSSI).	Receptor has intermediate tolerance to change i.e., recovery to pre-impact conditions is possible between 5 and 10 years. The receptor is a protected feature of a nationally designated site (e.g., MCZ, SSSI).	Receptor is of intermediate economic value and/or is tolerable to change e.g., acceptable alternatives with minor financial consequences.
Low	Receptor has high capacity to return to pre-impact condition within 1 year or up to 5 years. The receptor is common or widespread or designated as locally important.	Receptor has high tolerance to change with recovery to pre-impact conditions between 1 and 5 years. Common and widespread habitats/species of no specific conservation value.	May affect behaviour but is not a nuisance to user, with acceptable financial consequences e.g., short-term, reversible changes.
Negligible	The receptor is tolerant to change with no effect on its character.	The receptor is tolerant to change with no effect on its character. Recovery expected to be relatively rapid, i.e., less than approximately six months following cessation of activity. Artificial, highly modified, and/or degraded benthic habitats/species of low/no conservation interest.	The receptor is tolerant to change with no effect on its character.

4.4.4. The Determination of Effect Significance

The significance of an effect, either adverse or beneficial, will be determined using a combination of the magnitude of the impact and the sensitivity of the receptor. A matrix approach is proposed to be used throughout all topic areas to ensure a consistent approach within the assessment.

The terms assigned to categorise the significance of effects, where they are predicted to occur, can be described as follows:

- **Negligible:** beneficial or adverse - where the Project would cause no discernible improvement in or deterioration of the existing environment.
- **Minor:** beneficial or adverse - where the Project would cause a barely perceptible improvement in or deterioration of the existing environment.
- **Moderate:** beneficial or adverse - where the Project would cause a noticeable improvement or deterioration of the existing environment.
- **Major:** beneficial or adverse - where the Project would cause a considerable improvement or deterioration of the existing environment.

For example, if the magnitude of the impact is assessed as High (negative) and the sensitivity of the receptor is assessed as Negligible, then the significance would be Minor adverse (see Table 4-4). Those effects which are assessed as Moderate or Major will be considered as Significant effects. It is expected that feasible and cost-effective project specific mitigation is proposed to avoid, reduce and offset the significance of the effect. It is also expected that the residual effect has been subject to measures such that the remaining effects are reduced to as low as reasonably practicable and that no further mitigation is feasible. Those effects which are assessed as Negligible and Minor will be considered as Not Significant effects. They can be adequately controlled by best practice and legal controls and opportunities to reduce the significance of effects through mitigation may be limited and are unlikely to be cost effective.

Table 4-4: Significance matrix

		Sensitivity			
		High	**Medium**	**Low**	**Negligible**
Negative magnitude	**High**	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Minor
	Low	Moderate	Minor	Minor	Negligible
	Negligible	Minor	Minor	Negligible	Negligible
Beneficial magnitude	**Negligible**	Minor	Minor	Negligible	Negligible
	Low	Moderate	Minor	Negligible	Negligible
	Medium	Major	Moderate	Minor	Negligible
	High	Major	Major	Moderate	Minor

Predictions of impact will be based on the best available data using a combination of professional judgement, expert knowledge and modelling where appropriate. The precautionary principle will be applied to ensure that potential effects are not ascribed unduly low probability of occurrence or low levels of significance.

4.4.5. Acknowledging Levels of Certainty

The assessment needs to be robust and so will seek to describe and take into account the degree of uncertainty inherent in, for instance, the data used in the assessment, the identification of activities and impacts, the confidence in determining impact magnitude and receptor sensitivity, and in assigning significance levels to predicted resulting effects.

4.5. Mitigation and Monitoring

Appropriate mitigation measures will be explored to eliminate, minimise or manage identified potentially significant effects on the environment. Best practice strategies for mitigation are widely practiced and will be followed when considering the methods of dealing with the environmental impacts of the Project. The strategy comprises the components listed in Table 4-5.

Where changes are required to be made to the design of the Project during the iterative assessment process, these measures will be clearly identified within the MEAp. The clear inclusion of these measures within the MEAp will demonstrate the commitment to these measures. Where required, these measures will be secured by the Marine Licence. By employing this method, the significance of effect presented for each identified impact may be presumed to be representative of the maximum residual effect that the Project will have, should it be approved and constructed absent any specific mitigation.

The assessment is then repeated for the revised 'maximum adverse scenario' until:

- The effect has been reduced to a level that is not significant; or
- No further changes may reasonably be made to the design parameters in order to reduce the magnitude of the impact, thereby permitting the presentation of an effect that is still significant.

In some instances, additional mitigation measures will be outlined in the topic chapters. Additional mitigation measures may be deemed necessary where:

- An effect is significant, even with embedded mitigation, but additional mitigation measures are available to reduce the level of effect; or
- Mitigation has been proposed but has not yet been agreed with regulators, stakeholders, etc. or it is unproven.

Where relevant, these additional mitigation measures will be outlined in the topic chapters, after the assessment of significance section.

Table 4-5 outlines the proposed mitigation strategy to be undertaken in the MEAp.

Table 4-5: Mitigation Strategy

Avoidance	Where viable, the Project will be redesigned to avoid impacts. Avoidance will also be considered during the assessment of alternative routes.
Reduction	Reduction (through the use of mitigation or different techniques) will be considered when all options for the avoidance of impacts have been exhausted or deemed to be impractical. For example, alternative technologies could be considered to reduce impact.
Compensation	Where the potential for avoiding and reducing impacts has been exhausted, consideration will be given to providing compensation for residual impacts to make the proposal more environmentally acceptable.
Remediation	Where adverse effects are unavoidable, consideration will be given to limiting the level of impact by undertaking remedial works.

4.6. Cumulative Effects

A Cumulative Effects Assessment (CEA) is required under Schedule 3, Paragraph 3(2)(e) of the Marine Works (EIA Regulations) 2007 (as amended). Cumulative effects are defined as those effects on a receptor that may arise when the Project is considered together with other existing and/or approved projects.

In the absence of specific Marine Licencing guidance for CEA, the approach to the CEA will be based on "PINS Advice Note 17: Cumulative effects assessment relevant to nationally significant infrastructure projects" (PINS, 2019) as the most appropriate proxy. Additional guidance from "A Strategic Framework for Scoping Cumulative Effects" (MMO, 2014) and "Marine Scotland Consenting and Licensing Guidance" (Marine Scotland, 2018) will also be used.

Cumulative impacts of the Project will be assessed to identify where there could be an accumulation of impacts on a sensitive receptor, which could result in the need for further mitigation (for instance a large number of minor effects may coincide to result in an adverse effect of greater severity/harm overall).

Cumulative impacts consider other proposed developments within the context of the Project and any other reasonably foreseeable proposals in the vicinity including:

- Those under construction.
- Permitted application(s), but not yet implemented.
- Submitted application(s) not yet determined.
- Projects on the Planning Inspectorate's Programme of Projects.
- Identified in the relevant Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited.
- Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.

It is proposed that projects that are built and operational at the time that survey data were collected have been classified as part of the baseline conditions but will be considered again if appropriate in the CEA.

For those projects that are only partially constructed or have only recently been completed, the full extent of the impacts arising from the development(s) may not be known and therefore will be included within the CEA.

In assessing the potential cumulative impact(s) for the Project, it is important to bear in mind that some projects, predominantly those 'proposed' or identified in development plans or at early project stages may or may not actually be taken forward. There is thus a need to build in some consideration of certainty (or uncertainty) with respect to the potential impacts which might arise from such proposals. For this reason, all relevant projects/plans considered cumulatively alongside the Project will be allocated into 'Tiers', reflecting their stage within the planning and development process. This allows the cumulative impact assessment to present several future development scenarios, each with a differing potential for being ultimately built out.

4.7. Transboundary Effects

The Espoo Convention sets out the obligations of Parties to assess the environmental impact of certain activities that have the potential to have transboundary effects at an early stage of planning and to notify and consult other States in cases where there is likely to be significant adverse environmental impact on those States.

The Marine Scheme lies wholly in UK waters. Given the distance to the UK EEZ boundary, there is no potential for transboundary impacts.

4.8. Consultation

The Applicants are committed to proactive, open and transparent dialogue and engagement with all stakeholders, regulators, and communities which may be affected by or indeed may affect the Project. The Applicants recognise that consultation is a critical activity in the development of a comprehensive and balanced assessment.

Engagement 'pre-scoping' has focused on providing stakeholders with the opportunity to influence the design of the Project. Feedback received throughout 2023 has influenced the selection of the proposed Landfalls and the position of the proposed submarine cable corridor. All pre-application engagement is being recorded in a stakeholder engagement tracker, a summary report outlining all pre-application engagement will be provided alongside the MEA.

As part of the assessment process, further engagement with statutory consultees, non-statutory consultees, and the public will take place. The onshore elements, in England and Scotland have statutory requirements for consultation as part of the terrestrial consenting processes. As a responsible developer, the Applicants will include the marine scheme in the onshore consultation to provide a holistic overview of the Project to the public. This engagement will provide an opportunity to:

- Identify potential concerns about the Project and use these to inform the preparation of the MEAp.
- Seek opinions on potential impacts and the approaches taken to determine significance of effects.
- Incorporate mitigation measures into the design of the Project in the early stages where possible.
- Take into consideration the expertise and knowledge of local communities, experts and interest groups.
- Encourage stakeholder participation in future decisions.
- Ensure stakeholders are fully informed of current information regarding all aspects of the Project throughout the full duration of the Project.

In addition, a formal process of Pre-Application consultation will be completed under the Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013 (the 2013 PAC Regulations).

Engagement will take the form of emails, phone calls, online and face-to-face meetings, and online or in-person engagement events. A Fisheries Liaison Officer (FLO), Brown & May Marine Ltd, has been engaged by the Applicants. The FLO will assist the Application with engagement with national and local fisheries associations and fishers. All feedback received from the Scoping Opinion issued by the MMO and MD-LOT and from engagement activities will be recorded and considered in the preparation of the MEAp. The MEAp will set out in each individual topic chapter how the relevant responses to the Scoping Report and any other engagement have been addressed in the assessment process.

Project websites have been created to inform the public about the Project. They can be viewed at https://www.nationalgrid.com/electricity-transmission/network-and-infrastructure/infrastructure-projects/eastern-green-link-3-and-4 and Eastern Green Link 4 - SP Energy Networks .These websites will be used to advise the public on any Project updates including consultation dates, Project timeline, and any changes in the design following the various consultations.

4.9. References

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5. Designated Sites

5.1. Introduction

As part of the Marine Licence Application (MLA), the Applicants are required to demonstrate that the potential beneficial and adverse effects of the Project on European sites (Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Ramsar sites), Marine Conservation Zones (MCZs), Nature Conservation Marine Protected Areas (NCMPAs), Sites of Special Scientific Interest (SSSIs) and other national conservation designations have been considered.

To comply with this requirement, separate stand-alone assessments must be completed and submitted by the Applicants to support the competent authorities decision-making process under the relevant legislation.

This chapter explains the different assessment processes required for designated sites and how these will be undertaken by the Applicants. The findings of the assessments will be summarised in the Marine Environmental Appraisal (MEAp).

5.2. International and National Conservation Designations

Sites can be protected under a range of different legislation in England and Scotland to conserve important habitats and species (JNCC, 2023). Table 5-1 lists the key international and national designations and provides a brief description of their scope. Typically, in the UK, sites which have been proposed as a designated site, but have not been formally designated, are treated as if they are already protected for the purposes of assessment.

Table 5-1: International and National Conservation Designations

Designation	Description
European Sites (SAC, SPA, Ramsar sites)	A collective term for sites protected up to 12 Nautical Miles (NM) from the coast under the Conservation of Habitats and Species Regulations 2017 (COHSR, 2017) (England) and The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (Scotland). The Conservation of Offshore Marine Habitats and Species Regulations 2017 (COMHSR, 2017) which includes both English and Scottish jurisdictions, applied to designated sites greater than 12 NM from the coast. SACs are designated for the protection of habitats listed under Annex I and species listed under Annex II of the European Habitats Directive. SPAs with marine components are designated for the protection of bird species listed under the Birds Directive 2009 (as amended) as Annex I species or those which are regularly occurring migratory species dependent on the marine environment for all or part of their lifecycle and are associated with intertidal or subtidal habitats within the SPA. Ramsar sites are 'wetlands of international importance' which contain representative, rare, or unique wetland types or are considered to be of importance for conserving biological diversity (JNCC, 2019). They are designated under the criteria of the Ramsar Convention on Wetlands which was ratified in the UK in 1976. For the purposes of legislation and management Ramsar sites are generally designated in association with relevant European sites and conservation objectives and advice on operations are provided as part of the relevant European site/European marine site.
Highly Protected Marine Areas (HPMAs)	Areas of the sea that allow the protection and full recovery of marine ecosystems, including all habitats, species and ecosystem processes within the site boundary, encompassing the seabed and water column (Defra, 2023). HPMAs prohibit extractive, destructive and depositional uses, allowing only non-damaging levels of other activities to the extent permitted by international law (JNCC, 2023). Three sites were designated in English waters (June 2023); North East of Farnes Deep (northern North Sea), Allonby Bay (Irish Sea) and Dolphin Head (eastern English Channel). This policy is specific to English waters only.
Marine Conservation Zones (MCZs)	MCZs are designated in English, Welsh and Northern Irish territorial and offshore waters under the Marine and Coastal Access Act 2009 (MCAA) to protect a range of nationally important habitats and species
Nature Conservation Marine Protected Areas (NCMPAs)	NCMPAs are a type of marine protected area that can be designated in Scottish territorial and offshore waters to protect nationally important habitats and species. The Marine (Scotland) Act and the UK Marine and Coastal Access Act 2009 include powers for Scottish Ministers to designate Nature Conservation MPAs.
Sites of Special Scientific Interest (SSSI)	SSSIs are designated for the protection of terrestrial or marine flora, fauna, geological, geomorphological or physiographical features of special interest (JNCC, 2022).

Designation	Description
	In England, they are designated by Natural England under the Wildlife and Countryside Act 1981 (as amended). In Scotland, changes to the Wildlife and Countryside Act 1981 apply through the Nature Conservation (Scotland) Act 2004 and Wildlife and Natural Environment (Scotland) Act 2011. Sites are designated by NatureScot.
National Nature Reserves (NNRs) / Marine Nature Reserves (MNRs)	NNRs are managed by organisations including Natural England (in England), the National Trust, Forestry Commission, The Royal Society for the Protection of Birds (RSPB), Wildlife Trusts, and local authorities. In Scotland, NNRs are managed by similar national organisations including NatureScot. They are areas of land which are set aside for the purpose of nature conservation as well as enabling public and educational access (Natural England, 2022). MNRs are designated under the Wildlife and Countryside Act 1981 for the conservation of marine flora and fauna and geological or physiographical features of special interest whilst providing opportunities for their study. MNRs may be established within 3 NM of the coast to the limits of UK territorial waters and encompass both the sea and the seabed.
National Parks	National Parks are funded by central government and managed by their individual authorities. They are designated as protected landscapes with the broad purpose of conserving and enhancing natural beauty, wildlife and cultural heritage and to promote understanding and enjoyment of the special qualities of national parks by the public. There are 15 National Parks in the UK (National Parks UK, 2023).
Areas of Outstanding Natural Beauty (AONBs)	AONBs are landscapes in England which are designated for their distinctive character and natural beauty. Their purpose is the identification and protection of such areas from inappropriate development (Natural England, 2018). AONBs are designated by Natural England under the Countryside and Rights of Way Act (2000).
National Scenic Area (NSA)	In Scotland, landscapes of national importance are designated by Scottish Ministers as National Scenic Areas (NSA). The legislation defines NSAs as areas "of outstanding scenic value in a national context", for which special protection measures are required. Part 10 of the Planning etc. (Scotland) Act 2006 gave NSAs a statutory basis by adding a new section to the Town and Country Planning (Scotland) Act 1997. The Town and Country Planning (National Scenic Areas) (Scotland) Designation Directions 2010 then brought this into force. NSAs are broadly equivalent to AONBs in England and Wales.
World Heritage Sites (WHS)	WHS are global sites identified by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) which are considered to be of exceptional importance for current and future understanding of cultural, scientific and environmental planetary issues (World Heritage UK, 2023). There are 33 WHS in the UK which are managed by local organisations.
UNESCO Biosphere Reserves	"Learning areas for sustainable development" which enable the study of interdisciplinary approaches to the sustainable use of biodiversity whilst maintaining its conservation (UNESCO, 2021). Biosphere reserves are internationally recognised, including terrestrial, marine and coastal ecosystems and are nominated by national governments. Their main functions include: • Conservation of biodiversity and cultural diversity • Economic development that is socio-culturally and environmentally sustainable • Logistic support, underpinning development through research, monitoring, education and training.
Marine Management Organisation (MMO) and Inshore Fisheries Conservation Authority (IFCA) Bottom-Towed Gear Byelaws	The MMO has the power to make byelaws within 0 – 200 Nautical Miles (NM) of the English coast to protected habitats and species from potentially harmful activities under the MCAA (MMO, 2023), Byelaws relating to fishing activities are managed by the IFCAs between 0-6 NM and by the MMO between 6 and 200 NM. Within 25 km of the Scoping Boundary both the NEIFCA, IFCA and MMO have established bottom-towed gear byelaws which prevent the use of certain fishing gear types to protect seabed habitats and species. There are no equivalent byelaws in Scotland, protection of marine habitats is enforced through their network of Marine Protected Areas and European Legislation to restrict fisheries, although the legislation is not intended to protect marine habitats specifically.

5.3. Assessment Approaches

5.3.1. Habitats Regulations Assessment (HRA)

5.3.1.1. Legislative Context

The 'Habitats Directive' (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) protects habitats and species of European nature conservation importance. Together with the 'Birds Directive' (Council Directive 2009/147/EC on the conservation of wild birds), the Habitats Directive establishes a network of internationally important sites (i.e., 'Natura 2000 Sites') designated for their ecological status. This includes SACs and SPAs and in accordance with the Office of the Deputy Prime Minister (ODPM) Circular 06/2005 (ODPM, 2005), Ramsar sites. Collectively SACs, SPAs and Ramsar sites are referred to as European Sites in UK legislation.

The Habitats Directives are transposed into UK law in the offshore area (>12NM from the coast) by The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) (COMHS) for both Scottish and English jurisdictions. The inshore area (<12NM from the coast) by the Conservation of Habitats and Species Regulations 2017 (as amended) (COHSR) in England and The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) in Scotland. The legislation is collectively referred to as the Habitats Regulations.

Under the Habitats Regulations, the competent authority is required to undertake a Habitats Regulations Assessment (HRA) to determine whether there is potential for a plan or project to have an adverse effect on a European Site, alone or in-combination with other plans or projects. The HRA process comprises four key stages including Screening for Likely Significant Effects (LSE), Appropriate Assessment (AA), assessment of alternative solutions and Imperative Reasons of Overriding Public Interest (IROPI). The Appropriate Assessment is undertaken by the competent authority based on information provided by the applicant, usually in the form of a Report to Inform an Appropriate Assessment (RIAA) or an HRA Report. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required.

There are four stages within the HRA process:

1. **Screening**: The process of identifying potentially relevant European and Ramsar sites, and whether the proposed project is likely to have a significant effect on the interest features of the site either alone or in-combination with other plans and projects. If it is concluded at this stage that there is no potential for LSE, there is no requirement to carry out subsequent stages of the HRA. In accordance with recent case law relevant to the Habitats Directive and summarised in European Commission (EC) Guidance (November 2018) screening is undertaken prior to the implementation of any potential mitigation measures.
2. **Appropriate Assessment and Integrity Test:** Where a LSE for a European or Ramsar site cannot be ruled out, either alone or in-combination with other plans and projects, it is necessary to provide further information to enable the competent authority to carry out an Appropriate Assessment of the implications of the project on the integrity of the site(s), either alone or in-combination with other plans and projects, in view of the site's conservation objectives. Where it is not possible to rule out an adverse effect on site integrity (AEoI) (integrity test), the HRA must progress to Stages 3 and 4.
3. **Assessment of Alternative Solutions**: Identifying and examining alternative ways of achieving the objectives of the project to establish whether there are solutions that would avoid or have a lesser effect on the site(s).
4. **Imperative reasons of over-riding public interest (IROPI):** Where no alternative solution exists and where an adverse effect on site integrity remains, the next stage of the process is to assess whether the development is necessary for IROPI and if so, the identification of compensatory measures needed to maintain site integrity or the overall coherence of the designated site network.

5.3.1.2. Assessment Approach

To identify relevant European sites for consideration in the shadow HRA the following approach will be adopted:

1. Identification of the potential impacts the Project could have on primary and qualifying features of European sites.
2. Identification of European sites that interact with, or potentially have connectivity with the Project.
3. Assessment of Likely Significant Effects.

The potential for likely significant effects will be assessed using a source-pathway-receptor model. The 'source' is defined as the individual elements of the proposed works that have the potential to affect the identified ecological receptors both within the European site and outside of it. The 'pathway' is defined as the means or route by which a source can affect an 'ecological receptor', defined as

the Qualifying Features (for SPAs) or Qualifying Interests (of SACs) for which conservation objectives have been set for the European sites under consideration.

Screening will be informed by a review of the publicly available datasets and the available literature that allows the characterisation of the receiving environment and supports the identification and assessment of potential impacts and their significance.

The examination, analysis and evaluation of the relevant information that supports the Screening process will follow the precautionary principle throughout. Mitigation will not be considered during screening. Where there is any uncertainty in the conclusion, the potential impact and European site will be screened through to the Appropriate Assessment stage of the process. It is at this stage that mitigation measures to reduce the scale or likelihood of potential adverse effects can be proposed and incorporated into the assessment, along with the presentation of further information to inform the assessment.

Where Screening concludes that Appropriate Assessment is required, a Report to Inform Appropriate Assessment (RIAA) will be prepared and submitted with the Marine Licence Application. The RIAA would be informed by the results of the seabed surveys to be carried out (see Chapters 6 and 7 for details of scope). Consultation with the MMO, MD-LOT, Natural England, NatureScot and the JNCC will be undertaken throughout the assessment process to ensure that the RIAAs provides sufficient information for the MMO (England) and MD-LOT (Scotland) to carry out the AA.

The conclusions of the HRA process will be summarised in the MEAp. It is proposed that two shadow HRAs would be prepared; one for English waters and one for Scottish waters, which will be submitted in support of the relevant Marine Licence Applications.

5.3.2. Marine Conservation Zone Assessment (MCZ)/Nature Conservation Marine Protected Area (NCMPA)

Section 126 (6) of the MCAA requires that applicants seeking to undertake an activity must satisfy the competent authority that there is no significant risk of the proposed activity hindering the achievement of the conservation objectives stated for the MCZ/NCMPA. There are three stages to the process for assessing the effects of a project on an MCZ/NCMPA.

1. Screening: The process of identifying whether S126 should apply to the project. Screening identifies whether the licensable activity is taking place within or near to an MCZ/NCMPA; and identifies whether the activity is capable of affecting (other than insignificantly) either the protected features of the MCZ/NCMPA or the ecological or geomorphological processes on which the protected features are dependent.
2. Stage 1 assessment: This stage considers whether there is a significant risk of the activity hindering the achievement of the conservation objectives stated for the MCZ/NCMPA. It considers whether there are alternative options of undertaking the activity that would create a substantially lower risk of hindering the achievement of the conservation objectives.
3. Stage 2 assessment: This stage looks at whether there are benefits to the public of proceeding with the project that clearly outweigh the damage to the environment and what measures the applicant will take to provide measures of equivalent environmental benefit to compensate for the damage which the project will have on the MCZ/NCMPA.

5.3.2.1. Approach

To identify relevant MCZ/NCMPAs for consideration in the MCZ/NCMPA Assessment the following screening approach will be adopted:

1. Identification of the potential impacts the Project could have on protected features (including establishing the zone of influence of potential impacts).
2. Identification of MCZ/NCMPAs that interact with, or potentially have connectivity with the Project.
3. Assessment of potential for Project to hinder the achievement of conservation objectives for the relevant MCZ/NCMPA(s).

A similar approach to that employed for European sites will be taken for MCZ/NCMPAs, in that assessment will use the source-pathway-receptor model. Screening will be informed by a review of the publicly available datasets and the available literature that allows the characterisation of the receiving environment and supports the identification and assessment of potential impacts and their significance. The precautionary principle will be followed throughout. Where there is any uncertainty the impact and site will be screened through to Stage 1 assessment.

If screening determines Stage 1 Assessment should be undertaken for an MCZ/MPA, the Applicant will provide sufficient information to inform the MMO (England) or MD-LOT (Scotland) assessment. The assessment provided by the Applicants will examine whether the Project presents any significant risk to the protected features of the MCZ/MPA such that it will hinder the achievement of the conservation objectives for the MCZ/MPA. The assessment is an examination of the likelihood of the risk rather than a certainty of the

risk. It is at this stage that mitigation measures to reduce the scale or likelihood of potential adverse effects will be proposed and incorporated into the assessment.

The conclusions of the MCZ/MPA Assessment process will be summarised in the MEAp. It is proposed that an MCZ Assessment would be prepared for English waters and a MPA Assessment for Scottish waters, which will be submitted in support of the relevant Marine Licence Applications.

5.3.3. Assessment of Impacts on Other Conservation Designations

Most other conservation designations identified in Table 5-1 are not present within the Study Area e.g., MNRs, NSAs, WHS, UNESCO Biosphere Reserves. Where a conservation designation is present, and the Project has the potential to impact the protected features, this will be discussed in the appropriate topic chapter of the MEAp. For example, impacts on habitats protected by a MMO/IFCA byelaw area will be assessed under the Intertidal and Subtidal Benthic Ecology Chapter, impacts on bird species cited in a SSSI will be assessed within the Ornithology Chapter, etc.

Table 5-2 presents the potential impacts which could result in an adverse effect on qualifying features of designated sites and therefore require consideration by the relevant topic chapter of the MEAp. Where applicable, a cross-reference has been provided to the relevant marine pressures established by the JNCC Marine Pressures-Activities Database v1.4 (2021) and Natural England or NatureScot's advice on operations for relevant designated sites.

Table 5-2: Other Conservation Designations - Potential Impacts to be Assessed in EA

Potential Impact	Relevant Marine Pressure(s)	Geomorphological Features	Intertidal and Subtidal Benthic Habitats and Species	Fish and Shellfish	Ornithology	Marine Mammals and Marine Reptiles
Temporary habitat loss/seabed disturbance	Abrasion/disturbance of the substrate on the surface of the seabed Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	✓	✓	✓	✓	✓
Permanent habitat loss	Physical change (to another seabed type or sediment type) Water flow (tidal current) changes including sediment transport considerations	✓	✓	✓	✓	✓
Temporary increase and deposition of suspended sediments	Changes in suspended solids (water clarity) Smothering and siltation rate changes (light) (heavy) Hydrocarbon & PAH contamination		✓	✓	✓	
Changes in distribution of prey or target species	-			✓	✓	✓
Visual disturbance	Above water noise				✓	✓
Collision with project vessels	Collision above water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery and structures). Collison below water with static or moving objects not naturally found in the marine environment.					✓

Potential Impact	Relevant Marine Pressure(s)	Geomorphological Features	Intertidal and Subtidal Benthic Habitats and Species	Fish and Shellfish	Ornithology	Marine Mammals and Marine Reptiles
Underwater noise changes	Underwater noise changes Vibration			✓		✓
Introduction or spread of marine invasive non-native species (MINNS)	Introduction or spread of invasive non-indigenous species		✓			
Electromagnetic changes/Barrier to species movement	Electromagnetic changes Barrier to species movement			✓		✓
Temperature increase	Temperature increase		✓	✓		
Accidental spills	Hydrocarbon & PAH contamination Transition elements & organo-metal (e.g., TBT) contamination	✓	✓	✓	✓	✓

5.4. Identification of Relevant Sites

Each assessment will define a relevant search area within which relevant designated sites will be identified, using the following principles:

- Any designated site within or adjacent to the Project which, using the Source-Pathway-Receptor model as described in section 5.3.2, may be affected by the Project.
- Any designated site within the likely Zone of Influence of the Project, following the Source-Pathway-Receptor model.
- Any European site that is designated for mobile Annex II species (under the Habitats Directive), Annex I bird species (under the Birds Directive) that have the potential to occur within the zone of influence and be affected by the Proposed Development.

For the purposes of scoping, a preliminary search area of 15 km has been used to identify conservation designations with marine components. Sites within the 15 km radius search area are listed in Table 5-3. 15 km is the largest zone of influence identified in the topic chapters for potential impacts and is based on the maximum tidal excursion. This search area will be reviewed and refined for each receptor by the individual assessments as more detail becomes available on the project description, consultation is undertaken with the statutory nature conservation bodies and the various marine environmental assessments, include the HRA, MCZ assessment and MEA are undertaken. Therefore, the list of conservation designations provided in Table 5-3, is a preliminary list and will be subject to change. Designated sites within England and Scotland are shown in Figure 5-1 (Drawing: C01494-EGL4-PROT-011) and Figure 5-2 (Drawing: C01494-EGL4-PROT-012).

Table 5-3: Conservation Designations within 15 km of Proposed Development

Site name	Designation	Intersects Scoping Boundary	Distance to Scoping Boundary
England			
Inner Dowsing, Race Bank and North Ridge SAC	SAC		6.75 km
Saltfleetby – Theddlethorpe Dunes and Gibraltar Point SAC	SAC	✓	
Humber Estuary SAC	SAC		4.26 km

Site name	Designation	Intersects Scoping Boundary	Distance to Scoping Boundary
Southern North Sea SAC	SAC	✓	
Greater Wash SPA	SPA	✓	
Humber Estuary SPA	SPA	✓	
Holderness Offshore MCZ	MCZ	✓	
Farnes East MCZ	MCZ		6.29 km
North East of Farnes Deep HPMA	HPMA		0.08 km
Humber Estuary Ramsar	Ramsar	✓	
Chapel Point – Wolla Bank SSSI	SSSI		2.09 km
Humber Estuary SSSI	SSSI		4.34 km
Saltfleetby – Theddlethorpe Dunes SSSI	SSSI	✓	
Sea Bank Clay Pits SSSI	SSSI		0.16 km
Donna Nook NNR	NNR		6.26 km
Saltfleetby-Theddlethorpe Dunes NNR	NNR	✓	
Scotland			
Isle of May SAC	SAC		2.22 km
Firth of Tay and Eden Estuary SAC	SAC		14.3 km
Outer Firth of Forth and St Andrews Bay Complex SPA	SPA	✓	
Forth Islands SPA	SPA		0.67 km
Firth of Forth SPA	SPA	✓	
Cameron Reservoir SPA	SPA		9.08 km
Firth of Tay and Eden Estuary SPA	SPA		14.3 km
Firth of Forth Banks Complex MPA	MPA		1.69 km
Firth of Forth Ramsar	Ramsar	✓	
Cameron Reservoir Ramsar	Ramsar		9.08 km
Firth of Tay and Eden Estuary Ramsar	Ramsar		14.3 km
Isle of May NNR	NNR		2.91 km
Isle of May SSSI	SSSI		2.91 km
Firth of Forth SSSI	SSSI	✓	
Forth Islands SSSI	SSSI		7.45 km
Bass Rock SSSI	SSSI		7.61 km
Inchmickery SSSI	SSSI		9. 35 km
Cameron Reservoir SSSI	SSSI		9.08 km
Kilconquhar Loch SSSI	SSSI		4.91 km
Eden Estuary SSSI	SSSI		14.3 km

600000

800000

6200000

6000000

Firth of Tay and Eden Estuary SAC
Isle of May SAC
Tweed Estuary SAC
Berwick to St Mary's MCZ
Aln Estuary MCZ
Coquet to St Marys MCZ
North East of Farnes Deep MCZ
Farnes East MCZ
Fulmar MCZ
Swallow Sand MCZ
Dogger Bank SAC
Runswick Bay MCZ
Southern North Sea SAC
Humber Estuary SAC
Saltfleetby and Theddlethorpe Dunes & Gibraltar Point SAC
Saltfleetby and Theddlethorpe Dunes & Gibraltar Point SSSI
Flamborough Head SAC
Markham's Triangle MCZ
Holderness Offshore MCZ
Holderness Inshore MCZ
Humber Estuary SAC
Sea Bank Clay Pits SSSI
Greater Wash SPA
North Norfolk Sandbanks and Saturn Reef SAC
Inner Dowsing Race Bnk and North Ridge SAC
0 2.5 5 km

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800000

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Export Date: 21/12/2023

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SP Energy Networks

Designated Sites Within English Study Area

C01494b-EGL4-PROT-011-A

- Exclusive Economic Zone Limit (EEZ)
- 12NM Limit
- Scottish Adjacent Waters
- Relevant Designated Sites Search Area
- EGL 4 Scoping Boundary

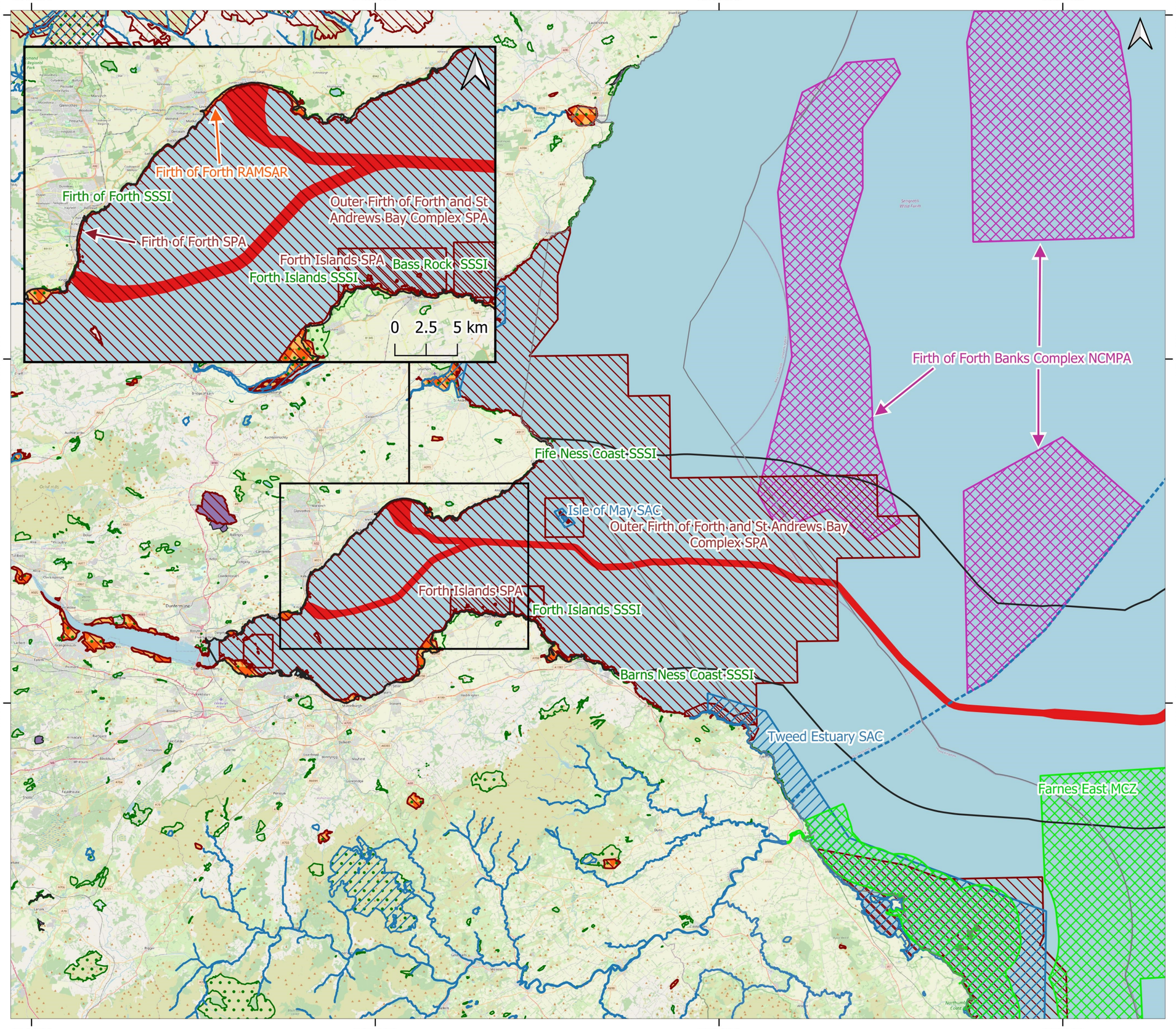
Protected Sites

- Special Area of Conservation (SAC)
- Marine Conservation Zone (MCZ)
- Special Protection Area (SPA)
- Nature Conservation Marine Protected Area (NCMPA)
- National Nature Reserve (NNR)
- Site of Special Scientific Interest (SSSI)
- RAMSAR Site

0 10 20 NM

0 25 50 km

Date	21/12/2023
Coordinate System	ETRS89 / UTM Zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	Meters
Scale at A3	1:1,400,000
Created	EP
Reviewed	S Pearce
Authorised	A Farley



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SP Energy Networks

Designated Sites Within Scottish Study Area

C01494b-EGL4-PROT-012-B

- 12NM Limit
- Scottish Adjacent Waters
- Relevant Designated Sites Search Area
- EGL 4 Scoping Boundary

Designated Sites

- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Nature Conservation Marine Protected Area (NCMPA)
- Marine Conservation Zone (MCZ)
- National Nature Reserve (NNR)
- Site of Special Scientific Interest (SSSI)
- RAMSAR

0 7.5 15 NM

0 10 20 km

Date	04/01/2024
Coordinate System	ETRS89 / UTM Zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	Meters
Scale at A3	1:550,000
Created	EP
Reviewed	SP
Authorised	AF

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Export Date: 04/01/2024

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6. Marine Physical Processes

This chapter of the Scoping Report describes the potential impacts arising from the construction, operation (including maintenance and repair) and decommissioning of the Eastern Green Link 4 (EGL 4) hereafter referred to as 'the Project' on marine physical processes. The marine physical environment includes the following elements:

- Hydrodynamics including water levels, currents, waves and winds;
- Geomorphology including bathymetry, geology, surficial sediments and substrate; and
- Sediment transport, including suspended sediment.

In addition, water and sediment quality is also included in this chapter due to the close linkages with marine physical processes.

There may be interrelationships related to the potential effects on marine physical processes and other disciplines. Therefore, please also refer to the following chapters:

- Chapter 7 – Intertidal and Subtidal Benthic Ecology: will identify the potential impacts on supporting habitats and key prey species for marine mammals and marine reptiles.
- Chapter 8 – Fish and Shellfish: will identify the potential impacts on key prey species for marine mammals and marine reptiles.
- Chapter 9 – Intertidal and Offshore Ornithology.
- Chapter 10 – Marine Mammals and Marine Reptiles.
- Chapter 12 – Commercial Fisheries.
- Chapter 14 – Marine Archaeology.

6.1. Study Area Definition

The Scoping Boundary for the Project extends from Mean High Water Springs (MHWS) in England to MHWS in Scotland. It is nominally 1 km wide, 500 m either side of the centreline, however, it widens in areas where there is still optionality in the design e.g., to allow for micro-routeing around potential seabed features. It is anticipated that the Marine Licence application boundary will ultimately be 500 m following refinement and rationalisation as the Marine Environmental Assessment (MEA) and design process evolves.

There are two proposed Landfalls in England being considered at this stage of the environmental assessment process; Anderby Creek and Theddlethorpe. There are two proposed Landfalls in Scotland being considered at this stage of the environmental assessment process: one at Kinghorn and one in Lower Largo/ Lundin Links. These options will be subject to further technical feasibility work and stakeholder consultation and will be refined to one preferred option for inclusion in the subsequent Marine Licence application for the Project.

The Study Area for marine physical processes includes the Scoping Boundary plus an additional 15 km either side. This buffer is informed by the tidal excursion, which varies along the proposed submarine cable corridor. Regional scale modelling tools indicate that largest tidal excursions occur at the English proposed landfall, where they are 10 km on a mean tide (equivalent to around 14 km on a spring tide). Locally, some larger excursions can occur. In other areas of the proposed submarine cable corridor tidal excursions are much shorter, being around 5 km on a mean tide. The adoption of a 15 km buffer throughout provides a precautionary approach. The extent of the Study Area will be reviewed and refined for the MEA.

Kilometre Points (KPs) are used throughout this Chapter to provide context as to where within the Study Area a feature lies. KP 0 is defined at the Anderby Creek Landfall. As there are still alternative Landfalls being considered, KPs have been created along the longest route from the proposed English Landfall at Anderby Creek, around the Holderness Offshore Marine Conservation Zone (MCZ) to the proposed Scottish Landfall at Kinghorn. The KPs for this route are referenced as KP 0 to KP 524.9. Alternative options, which branch off this longest route, are route from the proposed English Landfall at Theddlethorpe to the point where it converges with the longest route (referenced as T_KP 0 to T_KP 18); and through Holderness Offshore MCZ, which is referenced as KP 0 to H_KP 40 and from the longest route where it branches off to the alternative proposed Scottish Landfall in Lower Largo/Lundin Links, which is referenced as L_KP 0 to L_KP 16.

6.2. Data Sources

Data sources for the baseline characterisation will be presented in accordance with relevant guidance for the topic. The datasets that will be used to inform the description of the baseline environment for the MEA are described in the following sub-sections.

6.2.1. Site-specific Survey Data

A site-specific geophysical survey will be carried out along the length of the proposed submarine cable corridor (including the landfall). The width of the survey will nominally be 500 m, but this may increase to 1 km in some areas if there are features of interest. Preliminary interpretation of the geophysical data will be undertaken onboard the survey vessel and environmental sampling stations will be selected based on this interpretation. Chemical analysis and Particle Size Analysis (PSA) of the grab samples from the benthic survey will also be undertaken which will be used to inform the MEA.

A method statement for the survey works will be agreed with regulators prior to the survey commencing.

6.2.2. Publicly Available Data

A desk-based review of publicly available data sources (literature and GIS mapping files) would be used to supplement the site-specific geophysical/geotechnical surveys and to describe the wider baseline marine physical environment. Table 6 -1 lists the key data sources which would be used in the assessment.

Table 6-1: Key publicly available data sources for Marine Physical Processes

Data Source	Description	Coverage	
		English Study Area	Scottish Study Area
The European Marine Observation and Data Network (EMODnet, 2020)	Digital Terrain Model (DTM)	✓	✓
UK Hydrographic Office (UKHO, 2014)	Admiralty bathymetric survey data used to generate navigational charts and a major data source in the EMODnet DTM.	✓	✓
Admiralty Total Tide (ATT) software package	Tidal planes and tidal diamonds informing water levels and tidal flows	✓	✓
Environment Agency Coastal Design Sea Levels for the UK (EA, 2018)	Coastal flood boundary conditions around the coast	✓	✓
UK climate change projections (UKCP, 2018)	Sea level rise predictions along the coast	✓	✓
UK Renewable Atlas (ABPmer, 2017)	Maps of tidal range (spring and neap), peak tidal flows (spring and neap) and mean tidal ellipses, annual wave heights and wind speeds.	✓	✓
SEASTATES (ABPmer, 2018)	Modelled hindcast wind and wave data.	✓	✓
Climate System Forecast Reanalysis (CFSR) (Saha et al., 2010)	Hourly hindcast wind data at 0.2 degree resolution, spanning 44 years (1979 to 2023), used to drive SEASTATES.	✓	✓
British Geological Society (BGS, 2021)	Maps of seabed sediments, quaternary deposit thickness and structural geology offshore.	✓	✓
Shoreline Management Plan – SMP3 (Scott Wilson, 2010).	Local annual surveys of coastline	✓	
Joint Nature Conservation Committee (JNCC) Coasts and seas of the UK (Barne et al., 1997)	Region 4 South-east Scotland: Montrose to Eyemouth - description of coastal landform, sediment transport and geology.		✓
JNCC Coasts and seas of the UK (Barne et al., 1995)	Region 6 Eastern England: Flamborough Head to Great Yarmouth – description of coastal landform, sediment transport and geology.	✓	

Data Source	Description	Coverage	
		English Study Area	Scottish Study Area
Kenyon and Cooper (2005)	Sediment transport pathways in the North Sea	✓	✓
Cefas (2016)	Suspended Particulate Matter (SPM) – monthly, seasonal and annual maps	✓	✓
Database on the Marine Environment (DOME, 2023)	Sediment quality data	✓	✓
Environment Agency Bathing Waters map and monitoring data (Magic, 2023)	Water quality	✓	
SEPA bathing waters (SEPA, 2023)	Water quality		✓
JNCC (2023)	Marine Designated Sites shape file layer.	✓	✓
Marine Scotland	Reports on Scottish Offshore Wind Farm (OWF) developments including Neart Na Gaoithe (Emu,2019) and Berwick Bank (which also includes the Marr Bank OWF site) (RPS, 2022)		✓
Crown Estate Marine Data Exchange	Environmental Impact Assessment Report (EIAR) for English OWF projects including Triton Knoll (RWE Npower, 2012), Lincs, Lynn and Inner Dowsing (Offshore wind power, 2003), Hornsea 1 and 2.	✓	
Marine Scotland	National Marine Plan interactive Marine Scotland - National Marine Plan Interactive (atkinsgeospatial.com)		✓

6.2.3. Additional Studies

Beyond the collection of site-specific geophysical and benthic survey data, no additional studies are proposed to inform this assessment.

6.3. Consultation

Consultation on the proposed Marine Scheme has not yet commenced for the marine physical processes topic.

Consultation will be undertaken with relevant stakeholders to supplement desk-top review, geophysical, geotechnical and physical-chemical data acquisition, studies and assessment as required.

The following bodies will be consulted during the MEA process, as a minimum to ensure the most-up-to-date information is collated.

Table 6-2: List of stakeholders to be consulted

England	Scotland
Marine Management Organisation (MMO)	Marine Directorate – Licencing Operations Team (MD-LOT)
Centre for Environment, Fisheries and Aquaculture Science (Cefas)	Centre for Environment, Fisheries and Aquaculture Science (Cefas)
Joint Nature Conservation Committee (JNCC)	Joint Nature Conservation Committee (JNCC)
Natural England (NE)	NatureScot
Environment Agency	Scottish Environmental Protection Agency (SEPA)

6.4. Baseline Characterisation

This section has been split into the following sub-sections to provide an overview of the marine physical processes baseline in the Study Area:

- English baseline characterisation
- Scottish baseline characterisation

6.4.1. English Baseline Characterisation KP 0 to KP 418.7

6.4.1.1. Bathymetry and Seabed Features

The EMODnet Digital Terrain Model (DTM) has been used to inform the baseline understanding of bathymetry and tidal levels across the Study Area. The DTM is based on bathymetric data from various sources including UKHO survey data.

Water depths across the English Study Area generally increase with distance along the proposed submarine cable corridor, being 30 m below Mean Sea Level (MSL) offshore of Spurn Head at KP 80, 60 m below MSL offshore of Flamborough Head at KP 145 and 75 m below MSL at the northern end of the English Study Area at KP 300 (Figure 6.1, Drawing: C01494-EGL4-BATH-003).

Other than the gradual deepening along the proposed submarine cable corridor, significant bathymetric features in the English Study Area are constrained to within approximately 50 km of the Lincolnshire coast where the naturally deep channel of the Silver Pit lies adjacent to numerous shoals and banks including the Triton Knoll sand bank, Inner Dowsing Falls and Outer Dowsing Shoal.

6.4.1.2. Water Levels

Data from the UK renewables atlas (ABPmer, 2017) and the ATT software package have been used to inform the baseline understanding on tidal levels across the Study Area, while data from the Environment Agency's coastal flood boundary conditions (EA, 2018) and from the UK climate change projections (UKCP18) have been used to inform the baseline understanding of non-tidal influences on water levels.

Water levels in the Study Area are predominantly driven by tidal processes. Tides in the Study Area are semi-diurnal, with two high and two low tides per day. Tidal planes have been extracted from the ATT software package at Skegness (at the southern extent of the Study Area on the coast) and at T022B (approximately 28 km west of KP 395) and are given in Table 6-3. The tides vary across the English Study Area, with largest spring tidal ranges of approximately 6 m close to the proposed landfalls, reducing offshore and northwards to 2.5 m at the northern extent of the English Study Area. Neap tidal ranges are approximately half the spring tidal range. The tide arrives from the north with high water at the northern end of the English Study Area occurring approximately three hours before high water at the proposed landfalls.

Non-tidal or meteorological effects can also influence the water level. The height of a 1 in 200-year return period storm surge near the proposed landfalls in the English Study Area is 4.8 m above MSL (EA, 2018).

UKCP18 suggests an increase in MSL of more than 0.7 m at 2100 along the Lincolnshire coastline. Future changes in storm surges have been predicted to be indistinguishable from background variation (Lowe et al., 2009), although extreme surge level event frequency is likely to increase (IPCC, 2021).

Table 6-3: Tidal levels extracted from ATT at locations in the English Study Area

Tidal Plane	Tide Level (m relative to MSL)	
	Skegness	T022B – approx. 28 km west of KP 395
Highest Astronomical Tide (HAT)	3.6	1.9
MHWS	2.9	-
Mean High Water Neap (MHWN)	1.36	-
Mean Low Water Neap (MLWN)	-1.5	-
Mean Low Water Spring (MLWS)	-3.1	-
Lowest Astronomical Tide (LAT)	-3.8	-2.1

6.4.1.3. Currents

Data from the UK renewables atlas (ABPmer, 2017) and the ATT software package have been used to inform the baseline understanding on tidal flows across the English Study Area. Peak spring tidal flows across the English Study Area are shown in (Figure 6.2, Drawing: C01494-EGL4-GEO-006)

Tidal currents in the English Study Area are generally orientated southwards on the flood tide and northwards on the ebb tide. The currents close to the proposed landfalls in the English Study Area are bi-directional in nature, aligned with the coast, while currents become slightly more orbital in nature offshore. Fastest currents occur offshore of Spurn Head where peak spring tide current speeds are up to approximately 1.4 m/s. Current speeds reduce inshore and in a northward direction with spring tide current speeds of 1 m/s close to the proposed landfalls and of 0.45 m/s at the northern end of the English Study Area. Peak neap current speeds are approximately half the quoted peak spring tide current speeds.

There is a slight dominance in the southward flowing flood currents, particularly in the southern part of the English Study Area. Superimposed on the regional scale flow pattern, local flow variations can be expected to occur in response to bathymetric features (for example to realign with channel features, or around banks).

Surge driven flows in the Study Area are not expected to contribute significantly to sediment transport (Kenyon and Cooper, 2005).

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Bathymetry

C01494b-EGL4-BATH-003-A

- Exclusive Economic Zone Limit (EEZ)
- Scottish Adjacent Waters
- 12NM Limit
- EGL 4 Scoping Boundary
- EGL 4 Study Area

EMODnet Bathymetry 2020 (metres)

- -186.3
- -180.0
- -170.0
- -160.0
- -150.0
- -140.0
- -130.0
- -120.0
- -110.0
- -100.0
- -90.0
- -80.0
- -70.0
- -60.0
- -50.0
- -40.0
- -30.0
- -20.0
- -10.0

0 25 50 NM

0 50 100 km

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400000 500000 600000 700000 800000 900000

6400000 6300000 6200000 6100000 6000000 5900000

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Peak Flow for a Mean Spring Tide

C01494b-EGL4-GEO-006-B

- Exclusive Economic Zone Limit (EEZ)
- 12NM Limit
- Scottish Adjacent Waters
- EGL 4 Scoping Boundary
- 15km Study Area

Peak Flow ABPmer 2017 (m/s)

- <0.11
- 0.11 - 0.26
- 0.26 - 0.51
- 0.51 - 0.76
- 0.76 - 1.01
- 1.01 - 1.26
- 1.26 - 1.5
- 1.5 - 1.75
- 1.75 - 2
- 2 - 2.51
- 2.51 - 3.01
- 3.01 - 3.51
- 3.51 - 4
- >4.00

0 25 50 NM

0 50 100 km

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6.4.1.4. Winds and Waves

Climatological wind and wave data from SEASTATES (ABPmer, 2018) have been used to inform the baseline understanding of the wind and wave climate across the Study Area. SEASTATES is driven by the CFSR wind dataset (Saha et al., 2010).

Prevailing winds across the English Study Area are from the south to west sectors. The strength of the winds increases with distance offshore (due to the effect of coastal sheltering to the dominant wind directions inshore), with mean wind speeds of 6.4 m/s at KP 13 (close to the proposed landfalls), increasing to 8.1 m/s at KP 297 (close to the northern extent of the English Study Area). Wind roses at KP 13 and KP 297 are shown in Figure 6.3.

The wave climate across the English Study Area is controlled by a combination of locally generated wind waves and swell waves generated elsewhere in the North Sea. The primary wave direction along the proposed submarine cable corridor changes, with waves most frequently from the northeast close to the proposed landfalls and from the north further offshore. This change reflects the varying fetch lengths for different wind directions with distance along the proposed submarine cable corridor.

In addition to the change in direction, wave heights reduce in an inshore direction as a result of friction effects in the shallower nearshore waters. Mean significant wave heights close to the northern extent of the English Study Area (at KP 297) are 1.7 m, reducing to 0.6 m close to the proposed landfalls (at KP 13). There is a seasonal trend in the wave climate with smallest mean significant wave heights in the summer months and largest mean significant wave heights in the winter months (up to 2.1 m at KP 297). Wave roses at KP 13 and KP 297 are shown in Figure 6.3.

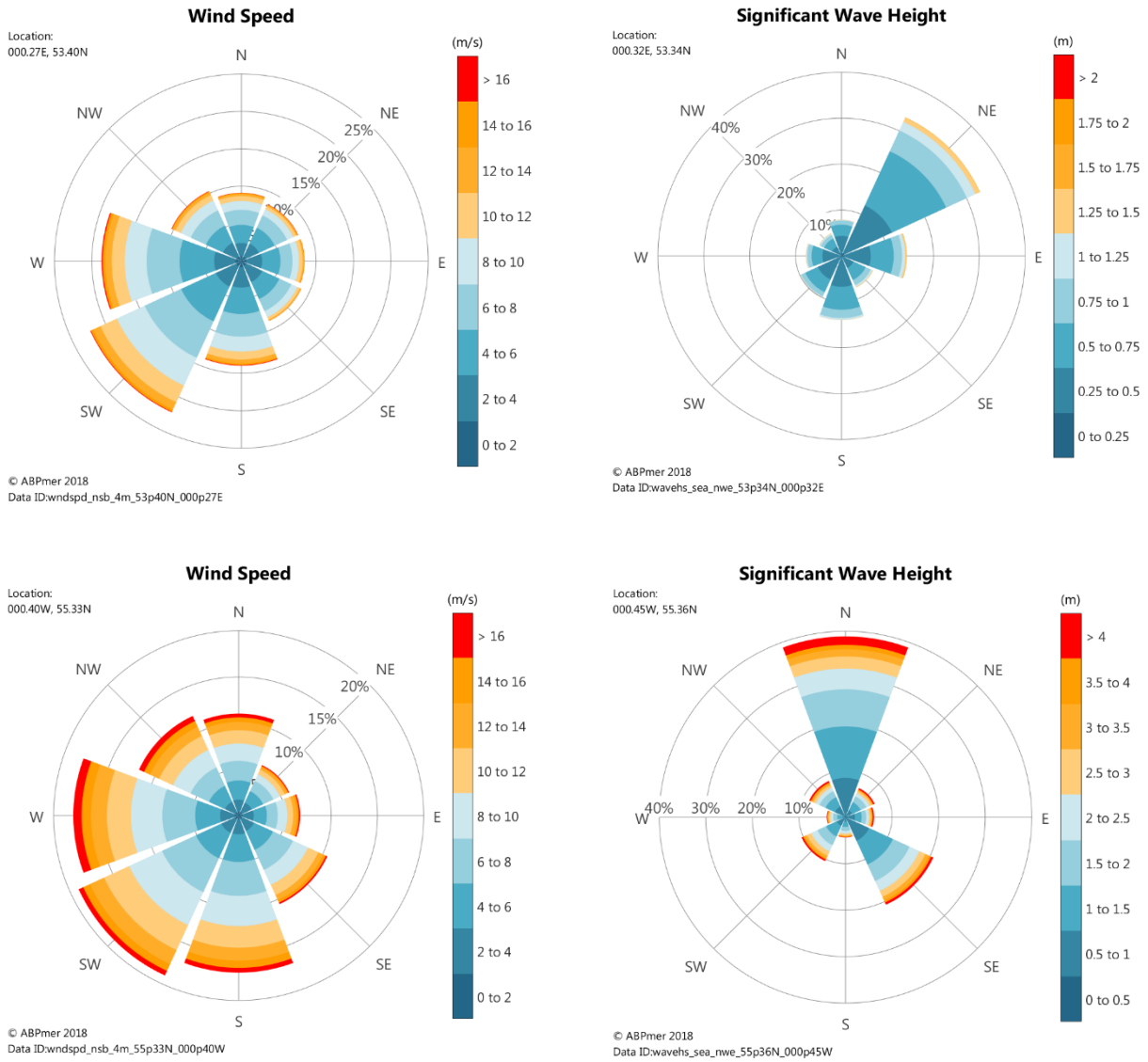

Figure 6-3: Wind and wave roses at KP 13 (upper panels) and KP 297 (lower panels) (ABPmer, 2018).

6.4.1.5. Geology and Seabed Sediments

The bedrock geology across the English Study Area is characterised by chalk at the southern end of the proposed submarine cable corridor, Mudstone and Limestone to the north of Flamborough Head and undifferentiated Triassic rocks (mix of rock, siliciclastic, argillaceous and sandstone) at the northern extent.

The thickness of quaternary deposits across the Study Area is typically between 5 and 20m, with some localised patches of thicker deposits (of more than 50 m) in the southern section of the proposed submarine cable corridor (mainly to the south of Spurn Point) and some areas of thinner deposits (less than 5 m) offshore at to the north of Flamborough Head.

Surficial sediments in the English Study Area are predominantly a mix of sands and gravels, with sandy gravel dominating at the southern end and close to the proposed landfalls, transitioning to sand with some patches of slightly gravelly sand, gravelly sand and sandy gravel at the northern extent of the English Study Area (Figure 6.4, Drawing: C01494-EGL4-GEO-007).

The English Study Area intersects some active marine aggregate extraction zones including Humber (Areas 514/1, 514/2, 514/3 and 514/4) to the north of the proposed submarine cable corridor close to KP 53 and Off Saltfleet (Area 197), Humber Estuary (Area 400 and Area 106) and Humber Overfalls (Area 493) to the south of the proposed submarine cable corridor close to KP 29, all of which are licenced until at least the end of 2029.

6.4.1.6. Geomorphology and Sediment Transport

Net sediment transport in the English Study Area is southwards close to shore, driven by the tidal asymmetry (with residual tidal flows to the south) (Kenyon and Cooper, 2005). Further offshore there is a bed-load parting zone, beyond which the net sediment transport is northwards. The proposed submarine cable corridor between KP 89 and the KP 155 lies close to the bed load parting zone in an area of low net sediment transport. Further north the sediment transport is driven by wave action and little sediment transport is expected (with wave driven transport restricted to shoals and/or storm events).

6.4.1.7. Coastal Geomorphology

The coastline within the English Study Area extends along the Lincolnshire coast from Sand Hail Flats in the north to just north of Gibraltar Point in the south. The coastline is generally made up of soft geology (predominantly gravelly sand and gravelly muddy sand) with many wide sandy beaches to Donna Nook, decreasing in width towards Mablethorpe. The beaches and sand flats are accreting, fed by sediment from the eroding Holderness cliffs, with a greater build up occurring at the top of the beaches than at the bottom resulting in a steepening of the beaches (Scott Wilson, 2010).

At Donna Nook and Gibraltar Point there is extensive and well-developed saltmarsh. In some locations (including Donna Nook, Saltfleetby and Gibraltar Point) sand dunes have formed.

The beaches between Saltfleetby and Gibraltar Point are formed of a thin layer of sand, overlying clay. Historically during storms, the thin layer of sand has been eroded exposing the underlying clay. To counter this erosion the Environment Agency has undertaken beach nourishment along the entire coast between Mablethorpe and Skegness. Much of this coastline also has a variety of 'hard' defences and dunes behind the beaches which, along with the ongoing beach nourishment, provide protection against flooding.

The Lincolnshire shoreline management plan along the coastline within the English Study Area is to hold the line.

6.4.1.8. Sediment and Water Quality

Data from the Cefas Suspended Sediment Climatology model (Cefas, 2016) show that over the period between 1998 – 2015, mean SPM values are less approximately 35 mg/l close to the proposed landfalls (up to KP 7) reducing to 15 mg/l at KP 30 and 5 mg/l at KP 50. SPM is less than 1 mg/l from KP 172 to the northern extent of the English Study Area (Figure 6.5, Drawing: C01494-EGL4-GEO-008).

The proposed submarine cable corridors pass through the Water Framework Directive (WFD) Lincolnshire water body, which is classed as a moderately exposed macrotidal water body (Water body ID GB640402492000). There are designated Bathing Waters (BW) at Mablethorpe Town, Moggs Eye and Anderby. All three have achieved 'Excellent' status for 2022, having maintained this classification for the last four bathing seasons (based on samples taken from 2018 through to 2022). Unofficially, it is considered by the Environment Agency that the full coastline from Mablethorpe to Anderby is a bathing water, as discussed during a meeting with the Environment Agency in April 2023.

The concentrations of metals in sediments within the North Sea are generally higher in the coastal zone and around estuaries, decreasing offshore indicating that river input and run-off from land are significant sources. The sediments within the English Study Area are typically coarse sediments (sands and gravels with only low mud content), which pose a low risk for anthropogenic contaminants.

Analysis of sediment quality samples from the International Council for the Exploration of the Sea (ICES) DOME Portal (DOME, 2023) was conducted along the full length of the proposed submarine cable corridor. Reported concentrations of arsenic, mercury, cadmium, chromium, copper, nickel, lead and zinc were checked for all available samples. For all sample records, contaminant levels were below

Cefas Action Level (AL) 1. Sediment sampling from OWF studies also concluded that seabed sediment does not contain significant levels of pollution (although these studies were constrained to the southern part of the proposed submarine cable corridor only).

There are numerous closed disposal sites within the English Study Area, many of which are associated with OWF developments. These closed disposal sites include Spurn Head (HU100), Hornsea disposal area (HU209), Triton Knoll (HU204), West of Inner Dowsing Bank (HU200) and Sheringham Shoal drillings (HU123). One active dredge disposal site exists within the English Study Area - the Hornsea OWF disposal area (HU205).

The proposed submarine cable corridor passes through an area of gas fields, some of which remain in production. For the most part, the proposed submarine cable corridor avoids passing through any active gas fields, the only exceptions to this are for the alternative cable route through the Holderness offshore Marine Conservation Zone (MCZ), which passes through the Mercury gas field at H_KP 13 and the Ceres gas field at H_KP 16. Gas fields could be a potential source of sediment contamination, however as noted above, analysis of sediment samples indicated no elevated contaminants above Cefas AL 1.

Seabed Sediments

C01494b-EGL4-GEO-007-B

- Exclusive Economic Zone Limit (EEZ)
- Scottish Adjacent Waters
- 12NM Limit
- EGL 4 Scoping Boundary
- 15km Study Area

Seabed Sediment 250k

- 1.1.1 Mud
- 1.1.2 (gravelly) Mud
- 1.2.1 sandy Mud
- 1.2.2 (gravelly) sandy Mud
- 1.3.1 muddy Sand
- 1.3.2 (gravelly) muddy Sand
- 2.1.1 Sand
- 2.1.2 (gravelly) Sand
- 3.1.1 gravelly Sand
- 3.2.1 sandy Gravel
- 3.3.1 Gravel
- 4.1.1 gravelly Mud
- 4.2.1 muddy Gravel
- 4.3.1 gravelly muddy Sand
- 4.4.1 muddy sandy Gravel
- 5. Rock & boulders
- 6. No data at this level of Folk

0 25 50 NM

0 50 100 km

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Annual Mean Suspended Particulate Matter

C01494b-EGL4-GEO-008-B

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- Exclusive Economic Zone Limit (EEZ)
- Scottish Adjacent Waters
- 12NM Limit
- EGL 4 Scoping Boundary
- 15km Study Area

SPM Mean (mg/l) Cefas 2016

- 1
- 2
- 5
- 10
- 15
- 20
- 25
- 30
- 40
- 50
- 60

0 25 50 NM

0 50 100 km

Date	04/01/2024
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6.4.1.9. Designated Sites – England

Designated sites in the English Study Area, which are designated for the protection and conservation of marine habitats of relevance to marine physical processes are shown in Figure 6.6 (Drawing: C01494-EGL4-PROT-013) (JNCC, 2023).

The proposed submarine cable corridor passes through the following designated sites:

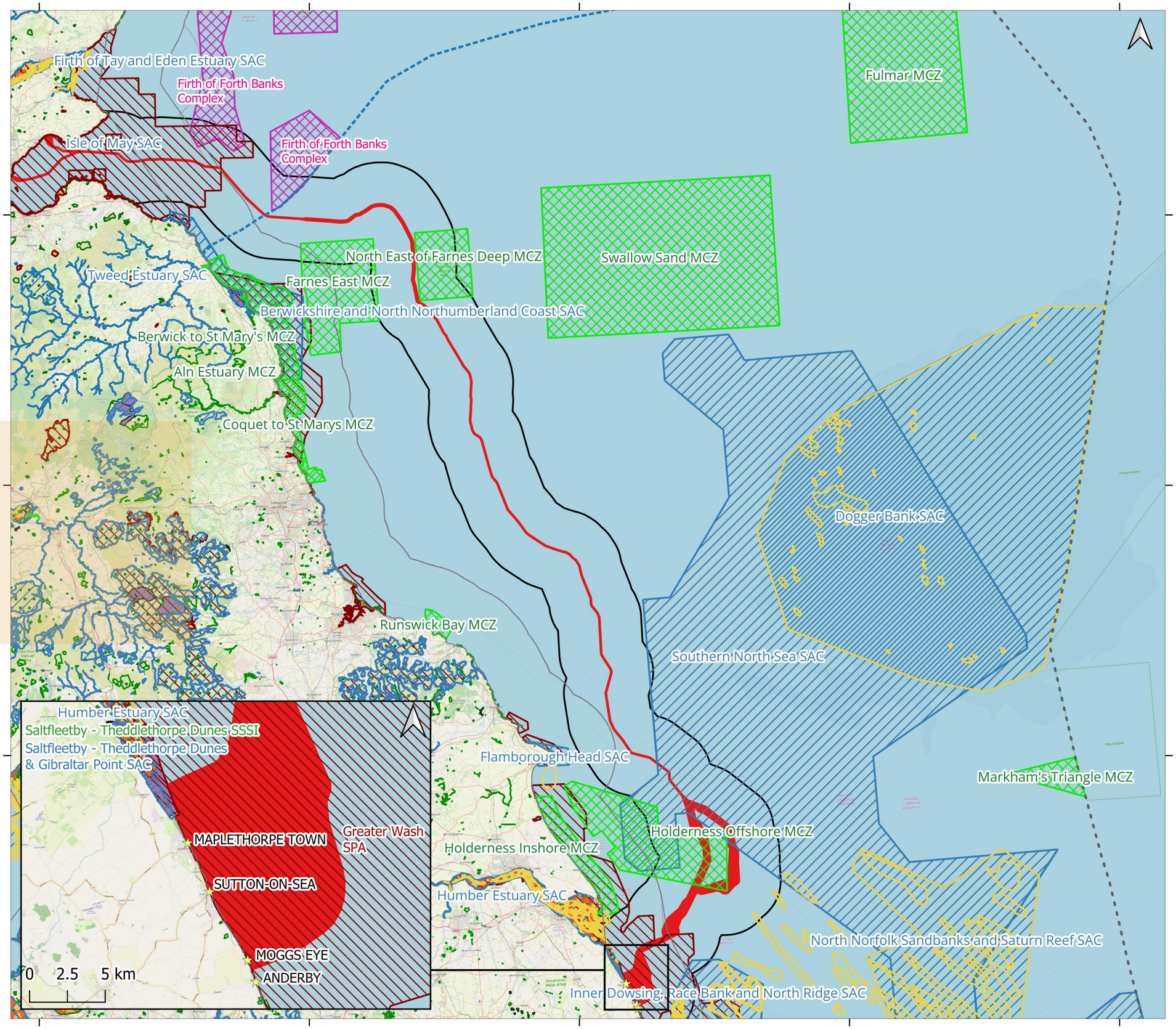
- Greater Wash SPA: which supports breeding and foraging areas for a large number of bird species. Specific marine habitats which support the designated bird species include intertidal mudflats and sandflats, subtidal sandbanks and biogenic reef.
- Holderness Offshore MCZ: an area of mixed coarse sediment and sand, supporting habitats for a wide variety of species, such as, ocean quahog, crustaceans (crabs and shrimp), starfish and sponges. The site is also a spawning and nursing ground for a range of fish species; and includes the northern top of the Silver Pit North Sea glacial tunnel valleys.
- Southern North Sea SAC: an area of importance for harbour porpoise. The mixed seabed of coarse and sandy sediments found here are an important physical characteristic, as these are preferred by harbour porpoise, due to availability of prey.
- Saltfleetby-Theddlethorpe Dunes and Gibraltar Point SAC: an extensive and complex onshore designation which exhibits a range of dune types including shifting dunes, fixed dunes with herbaceous vegetation and dunes which supports sea-buckthorn *Hippophae rhamnoides.* The dune slacks at this site are part of a successional transition between a range of dune features, and some have developed from saltmarsh to freshwater habitats.

In addition, the following designated sites lie within the wider English Study Area:

- Inner Dowsing, Race Bank and North Ridge SAC: a site characterised by sandbanks and biogenic reefs, protecting benthic communities & ecology;
- The North East of Farnes Deep MCZ: characterised by predominantly sandy sediment, with patches of gravelly sand and mud also lies within the English Study Area. The site is important for its 'mosaic of habitats' supporting a diverse range of marine flora and fauna; and
- Annex I Subtidal sand banks: there are a number of Annex I subtidal sand bank features which partially lie within the Study Area.

The Saltfleetby to Theddlethorpe Dunes Sites of Special Scientific Interest (SSSI) also lies within the English Study Area. The site is designated for important tidal sand and mudflats, marshes and sand dunes. The proposed submarine cable corridor for the landfall option at Theddlethorpe passes through the southern edge of this SSSI.

Please also refer to Chapter 5 Designated Sites for further information on designated sites and features



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Designated Sites and Bathing Waters in the English Study Area

C01494b-EGL4-PROT-013-B

- Exclusive Economic Zone Limit (EEZ)
- Scottish Adjacent Waters
- 12NM Limit
- EGL 4 Scoping Boundary
- 15km Study Area
- Designated Bathing Waters
- Annex I Sandbank

Designated Sites

- Special Area of Conservation (SAC)
- Marine Conservation Zone (MCZ)
- Special Protection Area (SPA)
- Nature Conservation Marine Protected Area (NCMPA)
- National Nature Reserve (NNR)
- Site of Special Scientific Interest (SSSI)
- RAMSAR Site

0 10 20 NM

0 25 50 km

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6.4.2. Scottish Baseline Characterisation KP 418.7 to KP 524.9

6.4.2.1. Bathymetry and Seabed Features

The bathymetry in the Scottish Study Area is relatively flat between KP 314 to KP 355, with depths typically being 70 to 80 m below MS, but deepening to around 90 m below MSL where it skirts to the west of North East of Farnes Deep (KP 330). At KP 370 the proposed submarine cable corridor turns west into the Firth of Forth and the bathymetry exhibits more variability as it traverses the channel and with some notable bathymetric features including Berwick Bank, Wee Bankie and the Isle of May to the north and Bass Rock to the south (Figure 6.1, Drawing: C01494-EGL4-BATH-003).

6.4.2.2. Water Levels

Data from the UK renewables atlas (ABPmer, 2017) and the ATT software package have been used to inform the baseline understanding on tidal levels across the Scottish Study Area, while data from the Environment Agency's coastal flood boundary conditions (EA, 2018) and from the UK climate change projections (UKCP18) have been used to inform the baseline understanding of non-tidal influences on water levels.

Water levels in the Scottish Study Area are predominantly driven by tidal processes. Tides in the Scottish Study Area are semi-diurnal, with two high and two low tides per day. The tides vary across the Scottish Study Area, with spring tidal ranges of approximately 2.5 m at the southern end, increasing to 4 m as the proposed submarine cable corridor crosses into the Firth of Forth and with peak ranges of just under 5 m at the proposed landfall sites (see tidal planes from ATT software in Table 6-4 at Kirkaldy and Methil which lie approximately 5 km north of the Kinghorn and 3 km southwest of Largo Bay, respectively). The tide arrives from the north so that the time of high water at the proposed landfalls occurs approximately one to two hours before the time of high water at the southern end of the Scottish Study Area.

Non-tidal or meteorological effects can also influence the water level. The height of a 1 in 200-year return period storm surge near the proposed landfalls in the Scottish Study Area is 3.9 m MSL.

UKCP18 suggests an increase in MSL of approximately 0.5 m at the year 2100 along the Firth of Forth coastline. Future changes in storm surges have been predicted to be indistinguishable from background variation (Lowe et al., 2009), although extreme surge level event frequency is likely to increase (IPCC, 2021).

Table 6-4: Tidal levels extracted from ATT at Kirkaldy and Methil

Tidal Plane	Tide Level (m relative to MSL)	
	Kirkaldy	Methil
HAT	3.0	3.1
MHWS	2.4	2.4
MHWN	1.2	1.2
MLWN	-1.1	-1.2
MLWS	-2.3	-2.4
LAT	-3.2	-3.3

6.4.2.3. Currents

Data from the UK renewables atlas (ABPmer, 2017) and the ATT software package have been used to inform the baseline understanding on tidal flows across the Study Area.

Tidal currents vary in terms of both current speed and direction across the Scottish Study Area. In the south of the Scottish Study Area tidal currents are orientated approximately north-south (with flows on the flood tide in a southward direction), while further along the proposed submarine cable corridor, the flows realign east-west into the Firth of Forth (with flows on the flood in a westward direction). The currents are orbital offshore and become more bi-directional as the proposed submarine cable corridor approaches the proposed landfalls.

Slowest currents occur offshore of the Firth of Forth where spring tide current speeds are approximately 0.4 m/s at KP 443. Current speeds slightly increase into the Firth of Forth with peak spring tide current speeds of close to 0.5 m/s at KP 501 (Figure 6.2, Drawing: C01494-EGL4-GEO-006). Peak neap current speeds are just over half of the quoted peak spring tide current speeds.

There is a slight dominance in the magnitude of peak northward flowing ebb currents, although the duration of the southward flowing flood currents tends to last slightly longer. The net effect is slight residual in northward tidal flow. Superimposed on this regional scale

flow pattern, local flow variations can be expected to occur in response to bathymetric features (for example to realign with channel features).

Surge driven flows in the Scottish Study Area are not expected to contribute significantly to sediment transport (Kenyon and Cooper, 2005).

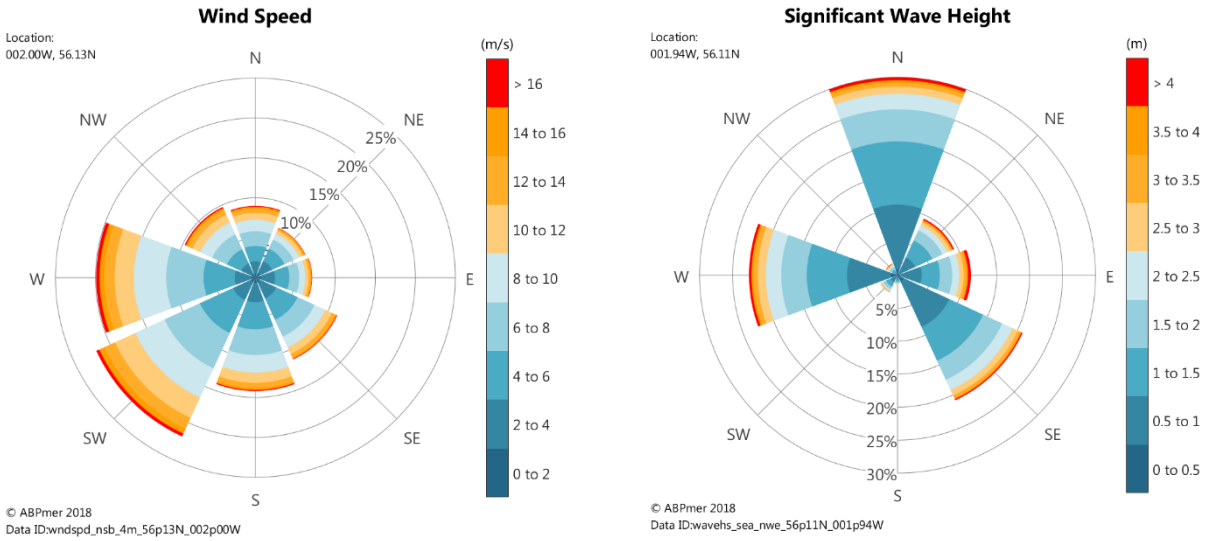
6.4.2.4. Winds and Waves

Climatological wind and wave data from SEASTATES (ABPmer, 2018) have been used to inform the baseline understanding of the wind and wave climate across the Study Area. SEASTATES is driven by the CFSR wind dataset (Saha et al., 2010).

Prevailing winds across the Scottish Study Area are from the south to west sectors. The strength of the winds increases with distance offshore (due to the effect of coastal sheltering), resulting in slightly higher wind speeds offshore of the Firth of Forth, with mean wind speeds of 6.8 m/s at KP 443, than at the proposed landfalls (with a mean wind speed of 5.3 m/s at KP 501). Wind roses at KP 403 and KP 501 are shown in Figure 6.7.

The wave climate across the Scottish Study Area is controlled by a combination of locally generated wind waves and swell waves generated elsewhere in the North Sea. Wave directions vary significantly along the proposed submarine cable corridor, in response to the varying fetch lengths for different wind directions with distance along the proposed submarine cable corridor. At KP 443 waves from the north, west and southeast sectors dominate, while further into the Firth of Forth (at KP 501) the geometry of the coastline results in a dominance of waves from the east (offshore) and the southwest (locally generated wind waves from inside the Firth of Forth).

Mean significant wave heights along the proposed submarine cable corridor reduce in a northward direction from around 1.7 m at the southern extent of the Scottish Study Area to 1.4 m at KP 443 and to 0.7 m at KP 501. The wave climate is informed by a regional hindcast and it is expected that at the proposed landfalls the waves will be notably lower than those from the nearby offshore data extraction point. Wave roses at KP 443 and KP 501 are shown in Figure 6.7.



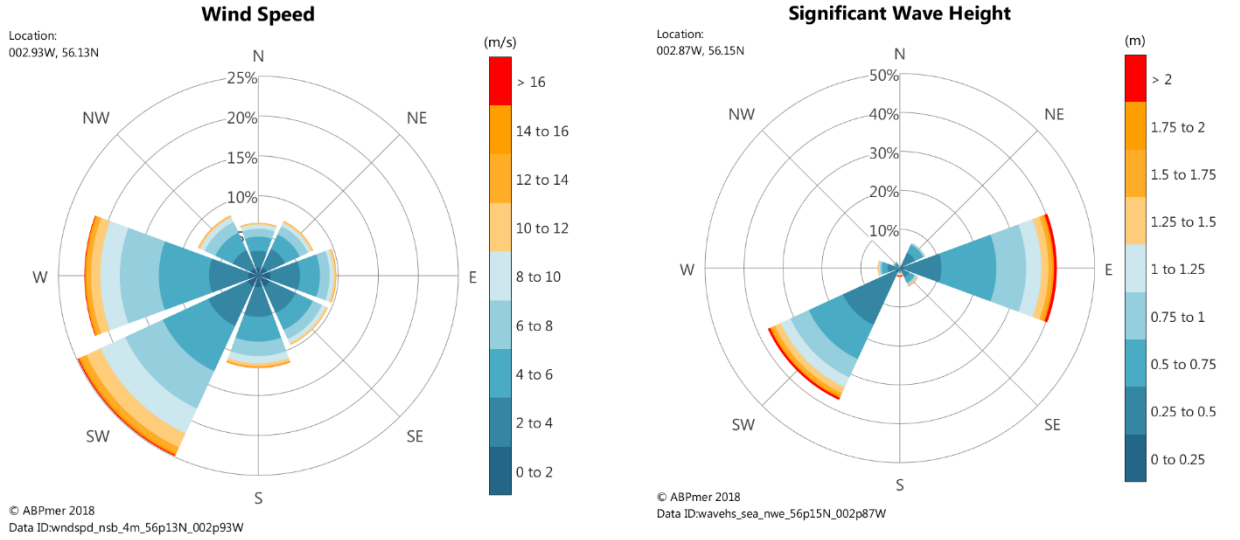


Figure 6-7: Wind and wave roses at KP 443 (upper panels) and KP 501 (lower panels) (ABPmer, 2018)

6.4.2.5. Geology and Seabed Sediments

The bedrock geology across the Scottish Study Area is characterised by Triassic rocks (mix of rock, siliciclastic, argillaceous and sandstone) at its southern extent. Further north and into the Firth of Forth the bedrock geology changes to mudstone and gypsum-stone and Dinantian rocks (mix of rock, siliciclastic, argillaceous and sandstone), with some areas of dolerite.

The thickness of quaternary deposits across the Scottish Study Area is typically between 5 and 20 m, with some discrete areas of both thinner (less than 5 m) and thicker (more than 50 m) deposits along the proposed submarine cable corridor.

Surficial sediments in the Scottish Study Area transition from sands and gravels at the southern extent to areas of finer sediments (sandy mud and muddy sand) into the Firth of Forth (Figure 6.4, Drawing: C01494-EGL4-GEO-007). There are also some discrete areas of mud and boulders.

6.4.2.6. Geomorphology and Sediment Transport

The net sediment transport in the southern part of the Scottish Study Area is to the north along the coast, driven by tidal flows (Kenyon and Cooper, 2005). Geophysical surveys undertaken for the Naert Na Goithe and Berwick Bank OWF studies indicate very low sediment mobility across the OWF sites themselves (which lie to the east and offshore of the proposed submarine cable corridor), but with evidence of a mobile bed along the OWF cable corridors (by the presence of small dunes) which cross the proposed submarine cable corridor (Emu,2019, RPS, 2022).

Further offshore and within the Firth of Forth the net sediment transport is wave-induced. The net drift on the northern coastline of the Firth of Forth and at the proposed landfalls is to the west with erosion occurring between Kinghorn and Largo Bay, while some accretion occurs in the eastern section of Largo Bay. On the opposite southern coastline, the net drift is more variable and as a result there are alternating areas of erosion and accretion (Barne et al., 1997).

6.4.2.7. Coastal Geomorphology

The Scottish Study Area at the proposed landfalls extends along the Fife and Lothian coastlines from Craighead in the north to Dunbar in the south and upstream in the Firth of Forth to the Forth railway bridge. Carboniferous rocks which are predominantly sand (arenaceous) are interbedded with limestone and mudstone. Coal seems, bedded ironstones and oil-shales can also be found.

Significant areas of intertidal sand are found at Largo Bay, Burntisland, Drum Sands (around Cramond Island) and Musselburgh, as well as to the east of the urban frontage of the Edinburgh conurbation at Gosford, Aberlady and Gullane Bays, with their dunes and golf links.

There are short stretches of cliffs along the coast south of Kirkcaldy and around North Berwick, reflecting the greater resistance to erosion of igneous rocks within the softer sedimentary sequence. The islands in the Firth, including Inchkeith and Bass Rock, are formed of similar igneous rocks.

Man-made coastlines occur adjacent to the larger towns, for example at Edinburgh on the opposite side of the Firth to the proposed landfalls.

Since coal pits closed and the dumping of mine waste ceased, many beaches have become deprived of the material that once protected them.

6.4.2.8. Sediment and Water Quality

Data from the Cefas Suspended Sediment Climatology model (Cefas, 2016) show that over the period between 1998 – 2015, mean SPM values are less approximately 1 mg/l throughout much of the Scottish Study Area. SPM values increase slightly close to landfall, however remain low, being less than 3 mg/l (Figure 6.5, Drawing: C01494b-EGL4-GEO-008).

The proposed submarine cable corridor passes through both the WFD Elie to Buckhaven and Buckhaven to Kinghorn water bodies. There are 26 designated BWs within the Scottish Study Area, with variable water status ratings from poor to excellent. The closest bathing water to the Kinghorn landfall is the Kinghorn Harbour Beach BW, which is currently rated as poor (having been poor or sufficient since 2017), while the two bathing waters to either side of Kinghorn Harbour Beach (Kinghorn Pettycur to the west and Kirkaldy to the east) are both rated as excellent. The proposed submarine cable corridor for the Lower Largo/Lundin Links landfall passes through the Leven BW which is rated as sufficient, while the bathing water of Lower Largo, which is to the east of Leven, is rated as poor.

The concentrations of metals in sediments within the North Sea are generally higher in the coastal zone and around estuaries, decreasing offshore indicating that river input and run-off from land are significant sources. The sediments within the Scottish Study Area are typically coarse sediments (sands and gravels with only low mud content), which pose a low risk for anthropogenic contaminants.

There are numerous closed disposal sites within the Scottish Study Area, including St. Abbs Head (FO050), Dunbar (FO060), Port Seton Site (FO045), Leith (FO046) and Kirkaldy (FO047). There are also a number of active dredge disposal sites including Narrow Deep (FO038), Oxcars Main (FO041), Oxcars Ext. A (FO042), Oxcars Ext. B (FO043) and Methil (FO048)

The proposed submarine cable corridor passes 4.5 km south of a historic munition's disposal site, named 'Isle of May – Firth of Forth'.

Analysis of sediment quality samples from the International Council for the Exploration of the Sea (ICES) DOME Portal (DOME, 2023) was conducted along the full length of the proposed submarine cable corridor. Reported concentrations of arsenic, mercury, cadmium, chromium, copper, nickel, lead and zinc were checked for all available samples. For all sample records, contaminant levels were below Cefas Action Level (AL) 1.

6.4.2.9. Designated Sites - Scotland

Designated sites in the Scottish Study Area, which are designated for the protection and conservation of marine habitats of relevance to physical processes are shown in Figure 6.8 (Drawing: C01494-EGL4-PROT-014). The proposed submarine cable corridor passes through the Outer Firth of Forth and St Andrews Bay Complex SPA, which extends along the coastline of the Firth of Forth and the coastal waters of the Forth itself. This area is considered of high importance for supporting seabirds and waterbirds as a feeding and nesting ground. Numerous breeding grounds are found within the SPA, and it is noted as an important refuge area for migrating birds.

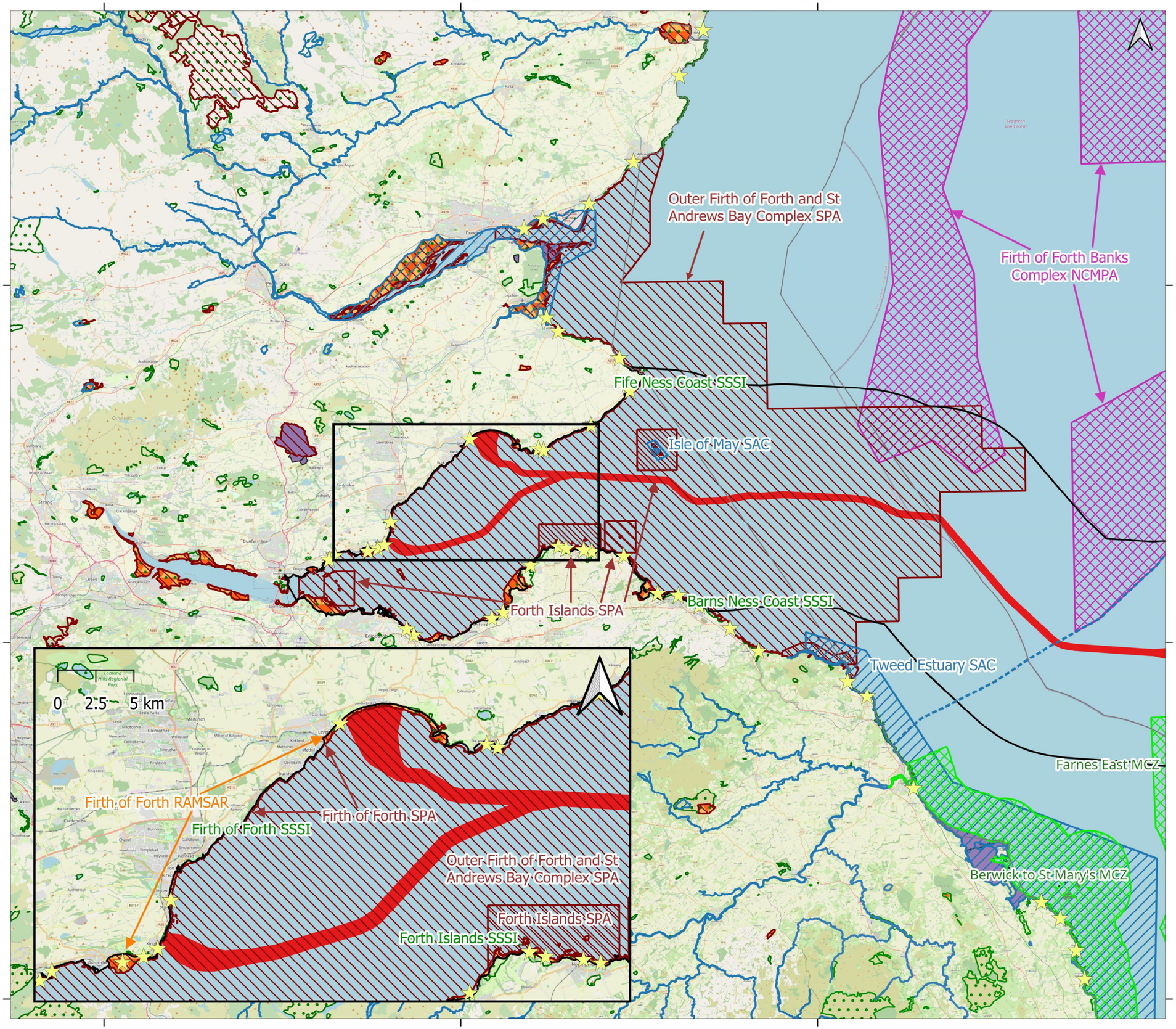
In addition, the following designated sites lie within the wider Scottish Study Area:

- parts of the Firth of Forth Banks Complex MPA which is characterised for its mixed sediments (a mosaic of different sands and gravels);
- The Forth Island SPA which is designated for high importance of bird breeding ground; and
- The Isle of May SAC which is primarily designated for the presence of a breeding colony of grey seals at the entrance to the Firth of Forth. Reef habitat is also present.

The Firth of Forth SSSI also lies within the Study Area. The site is designated for the variety of coastal habitats. The proposed submarine cable corridor passes through the Firth of Forth SSSI.

Designated Sites and Bathing Waters within Scottish Study Area

C01494b-EGL4-PROT-014-B



- Exclusive Economic Zone Limit (EEZ)
- Scottish Adjacent Waters
- 12NM Limit
- EGL 4 Scoping Boundary
- 15km Study Area
- Designated Bathing Waters

Designated Sites

- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Nature Conservation Marine Protected Area (NCMPA)
- National Nature Reserves (NNR)
- Site of Special Scientific Interest (SSSI)
- RAMSAR Sites

0 7.5 15 NM

0 10 20 km

Date	08/12/2023
Coordinate System	ETRS89 / UTM Zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	Meters
Scale at A3	1:530,000
Created	MH/EP
Reviewed	SP
Authorised	AF

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6.5. Proposed Assessment Methodology

A more detailed literature review will be developed for the MEA to expand on the high-level overview provided within this chapter of the MEA Scoping Report. Project-specific survey data will be used to enhance the understanding of the baseline conditions, with a focus on geophysical, geotechnical and benthic survey data.

The additional data will be used to inform the Cable Burial Risk Assessment (CBRA) which will consider:

- micro-routeing;
- minimum burial depths along the proposed submarine cable corridor;
- identification of potential burial tools and methods; and
- methods of cable protection where full cable burial cannot be achieved, or risk of subsequent cable exposure is high.

Existing studies from comparable projects (the 'Evidence Base') will be used to further inform the likely scale of any potential impacts.

The marine physical processes MEA will follow the general assessment approach outlined in Chapter 4 (Environmental Assessment Approach) of this MEA Scoping Report. The assessment of potential effects will be established using the standard Source-Pathway-Receptor Approach.

The assessment of marine physical processes will follow the guidance documents listed below where they are specific to this topic:

- 'General advice on assessing potential impacts of and mitigation for human activities on Marine Conservation Zone (MCZ) features, using existing regulation and legislation' (JNCC and Natural England, 2011);
- 'OSPAR Assessment of the Environmental Impacts of Cables' (OSPAR, 2009);
- 'Review of Cabling Techniques and Environmental Effects applicable to the Offshore Wind farm Industry'. Department for Business Enterprise and Regulatory Reform in association with Defra (BERR, 2008); and
- 'Advice Note Eighteen: The Water Framework Directive' (Planning Inspectorate, 2017).

The Study Area for the physical processes baseline within the MEA will be as currently outlined but will be further refined to focus on the final submarine cable route and may be further refined to consider the variation in tidal excursion along the proposed submarine cable corridor. The scope of the marine physical processes assessment is to characterise the baseline physical processes within the Study Area and to consider the magnitude and duration of potential impacts of the Project.

The assessment approach includes a range of desktop analyses and spreadsheet-based models and this will be supplemented by evidence from analogous assessments and monitoring data.

Currently both open cut trenching and trenchless construction techniques are proposed construction methods for the intertidal zones. For trenchless techniques (for example Horizontal Directional Drilling (HDD)) there will be no impact on the intertidal zone from construction activities. For open-cut trenching, a cofferdam may be required, and this could have an influence of along-shore sediment transport. A review of the baseline along-shore transport and associated drivers would be undertaken and used to qualify the potential for impact. Depending on the outcome of this qualitative assessment, numerical modelling tools may be applied to further quantify the potential impact.

Spreadsheet based models will be applied to assess the potential Suspended Sediment Concentration (SSC) and sedimentation associated with installation activities for a range of hydrodynamic conditions, sediment types and release rates to capture the impact (in terms of plume extent, concentration, duration of increases and extent and thickness of deposits on the seabed). The assessment will focus on the realistic worst case installation scenario. The available baseline information and planned geophysical, geomorphological and benthic surveys will provide the data inputs for this assessment. The effects will be assessed in terms of the difference caused relative to the normal range of natural occurrence and variability.

In view of the low percentage of fines present in the sediments along the proposed submarine cable corridor and due to the large existing evidence base, which includes multiple similar assessments using numerical modelling tools to assess impacts from cable installation for a range of methods, no new numerical hydrodynamic modelling is presently considered to be required.

The assessment of operational impacts associated with changes to the substrate and water depths associated with cable protection measures will quantify the areas of impact and relative changes in water depth. This will be considered alongside baseline information, results from the benthic survey and expert judgement to determine the likely impact on receptors.

A WFD assessment will be undertaken to assess the potential impacts of the Project on water and sediment quality. It is proposed that the WFD assessment will be presented as a technical appendix, and the results of the assessment will be presented within the Marine Physical Processes chapter of the MEA. The assessment of water quality impacts will focus on the impact on turbidity using spreadsheet-based models, with release of contaminated sediments having been scoped out of the assessment.

6.6. Scope of Assessment

A range of potential impacts on marine physical processes have been identified which may occur during the installation, operation (including maintenance and repair), and decommissioning phases of the proposed Project. The decision on whether an impact should be further assessed with the MEA is based on whether potentially significant impacts may arise. A summary of the proposed assessment scope is provided in Table 6-5.

A precautionary approach has been taken and where there is no strong evidence-base or the significance is uncertain at this stage the impact has been scoped 'in' to the MEA.

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

- Chapter 7 – Intertidal and Subtidal Benthic Ecology;
- Chapter 8 – Fish and Shellfish Ecology;
- Chapter 9 – Intertidal and Offshore Ornithology;
- Chapter 10 – Marine Mammals and Marine Reptiles; and
- Chapter 12 – Commercial Fisheries.

The scoping of indirect impacts from the identified marine physical processes pathways will be assessed within the relevant topics.

The physical processes features which are considered as potential receptors will be guided by the tidal excursion and will include:

- The adjacent coastline, particularly at proposed landfalls and in adjacent SSSIs (including Saltfleetby to Theddlethorpe Dunes);
- Nationally or internationally designated sites with seabed/sedimentary or geological interest features below Mean High Water Spring (MHWS); and
- Designated bathing waters.

Table 6-5: Scoping assessment of impacts on physical processes

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
Disturbance of sub-tidal seabed morphology.	Boulder clearance. Pre-sweeping Cable burial and trenching Deposit of external cable protection HDD Exit pits or cable laying vessel flotation pits.	Seabed geomorphology Subtidal Benthic Habitats Fish and Shellfish Ornithology Commercial fisheries	IN – While seabed preparation and submarine cable installation activities have the potential to directly disturb the seabed morphology, the proposed submarine cable corridor has been routed to avoid seabed features such as sandbanks, sandwaves and notable bathymetric depressions. However, there remains the potential for some pre-sweeping and for the requirement for deposits of external cable protection in some areas.	OUT – If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that localised repair works or remedial external cable protection may be required. In these circumstances pre-sweeping may be required to expose the section of cable in need of repair.	OUT - The significance of the effect of removing the cable during decommissioning is similar or of lower magnitude than construction.
Disturbance of intertidal morphology	Cable burial and trenching Deposit of external cable protection HDD Exit pits or cable laying vessel flotation pits.	Intertidal and coastal geomorphology	IN – At this stage of scoping, no decision has been made on the installation technique to be used. As noted in the project description this may be either a trenchless technique or an open cut technique. The open cut trenching option may require a cofferdam which would pose a barrier to along-shore coastal processes (although any effect would be short-lived) and as such this has been scoped in at this stage.	OUT – If the cable is installed correctly the potential for cable exposure due to any natural coastal retreat is minimal. The proposed landfalls are sited in areas of either low erosion, net accretion or where coastal management practices are to hold the line.	OUT - The significance of the effect of removing the cable during decommissioning is similar or of lower magnitude than construction.
Temporary increases in SSCs and subsequent deposition.	Boulder clearance, pre-lay grapnel runs/Cable burial/trenching	Water quality Seabed substrates Subtidal Benthic Habitats Fish and Shellfish Ornithology Commercial shellfisheries	IN – Sediment suspended during installation of the submarine cable could result in temporary increases in SSC and subsequent deposition once material re-settles to the bed.	OUT - If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. In the event that localised repair work is required, the significance of the effect will be of lower magnitude than during installation, being constrained to a smaller area.	OUT - It is expected that decommissioning activities will result in a lower magnitude effect than that already considered during construction.
Modifications to tidal and wave regimes and associated impacts to morphological features	Construction impacts, Presence of seabed cable protection,	Currents, water levels, waves bathymetry and seabed features.	OUT – The Project will have a narrow footprint (<10 m wide) in relation to the scale of physical processes driven by flow and wave action. Any effects will be highly localised and of a short duration. Scour/erosion may occur during construction; however, the landfall works will be of a short duration, and localised.	OUT – Changes in depth from cable protection will be minimal relative to the total water depth (not more than 5% reduction in depth) and will not significantly alter flows or waves.	OUT - There will be short term, localised disruption of the tide, wave and sediment transport regime while the cables and platform are removed. Any effects will be highly localised and of a short duration.

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
Release of contaminated sediments	Seabed activity such cable burial and trenching	Water quality Subtidal Benthic Habitats Fish and Shellfish Ornithology Commercial shellfisheries	OUT – The temporary resuspension of contaminants in sediments has the potential to result in adverse effects on water quality. However, there are no records indicating the presence of contaminated sediments within the Study Area at levels requiring further investigation.	OUT - If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that localised repair works, or remedial external cable protection may be required. In these circumstances the significance of the effect will be of lower magnitude than during construction.	OUT – There will be short term disruption of the sediments while the cables are removed but the effect will be a lower rate of sediment disturbance than during construction.
Accidental releases or spills of materials or chemicals	Presence of project vessels and equipment	Water quality & sediment quality	OUT - Project vessels and contractors will comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 which relate to pollution from oil from equipment, fuel tanks etc and release of sewage (black and grey water). It is a legal requirement that all vessels have a Shipboard oil pollution emergency plan (SOPEP). Compliance with Regulations will be sufficient to minimise the risk to the environment and no significant impacts are predicted.		
Temperature Increase	During the operation of an HVDC cable heat losses occur because of the resistance in the cable/conductor.	Sediment quality	OUT – not relevant to construction.	OUT - There are no specific regulatory limits applied to temperature changes in the seabed, although a 2°C change between seabed surface and 0.2 m depth is used as a guideline in Germany. Conservative calculations undertaken for Viking Link (which crosses German waters) concluded that heating in excess of 2 °C at 20 cm sediment depth will only occur if cables are bundled and buried to less than 0.75 m (National Grid and Energinet 2017). As yet the full CBRA has not been carried out. However, evidence from similar projects show that risk of shipping and fishing interactions that a minimum burial depth of 1.5 – 2 m is required (NeuConnect, 2019, GridLink, 2020). Any temperature changes will be localised to the immediate environment surrounding the cable and undetectable against natural temperature fluctuations in the surrounding sediments and water column. No significant effects are predicted.	OUT – not relevant to decommissioning.

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