VikingLink

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Viking Link

Bridging Document

End to End Environmental Assessment

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List of Abbreviation	
Abbreviation	**Meaning**
AC	Alternating Current
BBC	Boston Borough Council
BSH	Bundesamt für Seeschifffahrt und Hydrographie
°C	Degrees Celsius
DC	Direct Current
EEZ	Exclusive Economic Zone
EMF	Electromagnetic Field
EIA	Environmental Impact Assessment
ELDC	East Lindsey District Council
ES	Environmental Statement
EC	European Community
EU	European Union
EUNIS	European Union Nature Information System
FLO	Fishing Liaison Officer
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
HDD	Horizontal Directional Drilling
km	Kilometre
KP	Kilometre Point
kV	Kilovolt
LBEG	Landesamt für Bergbau, Energie und Geologie
LoD	Limits of Deviation
LPA	Local Planning Authority
MCAA	Marine and Coastal Access Act, 2009
MCZ	Marine Conservation Zone
MIND	Mass Impregnated Non-Draining
MMO	Marine Management Organisation
MHWS	Mean High Water Springs
MLW	Mean Low Water
m	Metre
MW	Megawatt

List of Abbreviation	
Abbreviation	**Meaning**
NCA	National Competent Authority
NGVL	National Grid Viking Link Limited
NL	The Netherlands
NKDC	North Kesteven District Council
Nm	Nautical Mile
PCE	Potential cumulative effect
PCI	Project of Common Interest
PRoW	Public Right of Way
rMCZ	Recommended Marine Conservation Zone
SAC	Special Area of Conservation
SCI	Site of Community Importance
SHDC	South Holland District Council
SNS	Southern North Sea
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TCC	Temporary Construction Compound
TJP	Transition Joint Pit
TWA	Temporary Working Area
UK	United Kingdom
UXO	Unexploded Ordnance

1 Introduction

1.1 The Viking Link Project

1.1.1 The Viking Link project ("the Project") is a proposed high voltage direct current (DC) electricity link between the British and Danish transmission systems connecting at Bicker Fen substation in Lincolnshire and Revsing substation in southern Jutland, Denmark. The Project will involve the construction of a converter station in each country, the installation of submarine and underground cables between each converter station and underground cables between the converter station and substation in each country.

1.1.2 Viking Link is in line with the European Commission's aim for an integrated energy market to ensure value for money for consumers and provides the opportunity to transport renewable energy to centres of consumption.

1.1.3 The interconnector has an approximate capacity of 1400 megawatt (MW), and crosses through the Exclusive Economic Zones (EEZ) of the United Kingdom (UK), the Netherlands, Germany and Denmark.

1.1.4 The Project is configured so that power would be able to flow in either direction at different times, depending on the prevailing supply and demand conditions in each country.

1.2 Project Partners

1.2.1 Viking Link is being jointly developed by National Grid Viking Link Limited (NGVL) and Energinet.

1.2.2 **National Grid Viking Link Limited** is a wholly owned subsidiary of National Grid Group and has been granted an interconnector licence by the energy regulator Ofgem. NGVL is legally separate from National Grid Electricity Transmission Plc. (NGET) which has the licence to own and operate the high voltage electricity transmission system in England and Wales.

1.2.3 **Energinet** is an independent public enterprise owned by the Danish Ministry of Energy, Utilities and Climate. The enterprise owns and operates Denmark's main electricity and natural gas grids.

1.3 Purpose of this Document

1.3.1 This document is referred to as a "Bridging Document" and is intended to provide an overall summary of the onshore and offshore elements and give an overview of the combined environmental effects of Viking Link. The Bridging Document will enable those with an interest in Viking Link to understand how the Project will affect them, and provides an overview of the main interfaces of the environmental assessments and the likely in-combination effects of the onshore and offshore elements of the Project.

1.3.2 The intention of this Bridging Document is not to convey all of the information relating to Viking Link and its potential effects on the environment. This document provides a summary of the

findings of the detailed environmental assessments which accompany the permit applications in each jurisdiction.

1.3.3 The summaries of the environmental assessments in each country are presented below. It should be noted that the presentation of results differs in each country, and follows the format required by the in-country process and expectations of the permitting authorities.

1.3.4 More detailed information on the Project and the environmental assessments is contained within the Viking Link website, and the permit applications and supporting documentation submitted within the respective jurisdictions.

1.4 The Reason for the Project

1.4.1 The electricity industry is undergoing unprecedented changes in the move towards a low carbon economy, which is seeing major investment in low carbon generation. Interconnectors are fundamental to developing European, British and Danish infrastructure.

1.4.2 All over Europe there is a trend towards expanding power grids with renewable generation and accessing more diverse generation sources. In the future, there will be a great deal more solar and wind energy and the power grids must be ready for this. Large quantities of energy will be transported greater distances and across borders en route from producer to consumer in order to provide electricity to meet peak demands.

1.4.3 The European Union (EU), the UK and Danish Governments support the continued development and expansion of interconnectors as a means of integration and providing a robust and resilient energy supply. The EU faces significant energy challenges which include the present dependency on fossil fuel generation and their contribution to global warming.

1.4.4 Interconnectors assist in improving Great Britain's and Denmark's security of supply and are one of the technologies that can assist with the integration of low carbon generation. Interconnectors also provide an important mechanism for responding and managing intermittency and excess surplus power associated with renewable generation.

1.4.5 The Project is in line with the European Commission's approach to an integrated energy market to ensure value for money for consumers. Viking Link would enable more effective use of renewable energy, provide access to sustainable electricity generation and improve security of electricity supplies. Thus it will benefit the socio economy of both countries (Denmark and United Kingdom).

European Context

1.4.6 EU countries have agreed a new 2030 Framework for climate and energy, including EU-wide targets and policy objectives for the period between 2020 and 2030.

1.4.7 European strategy recognises the urgent need to upgrade Europe's energy infrastructure and to interconnect networks across borders to meet the EU's core energy policy objectives of competitiveness, sustainability and security of supply[1].

1.4.8 The targets for 2030 are as follows:

- A 40% cut in greenhouse gas emissions compared to 1990 levels;
- At least 27% of electricity consumption to be derived from renewable energy; and
- At least 27% energy savings compared with the business-as-usual scenario.

1.4.9 The integration of rising levels of intermittent renewable energy requires a more interconnected European energy market with appropriate back-up supplies, which should be coordinated as necessary at regional level.

1.4.10 One of the proposed measures to meet the targets is increased interconnection capacity between EU countries. The stated wish is for EU Member States to achieve 10% interconnection of that country's generation capacity by 2020, aiming for 15% by 2030.

1.4.11 Viking Link is in line with the EU's aim for an integrated energy market to ensure value for money for consumers and provides the opportunity to transport renewable energy to centres of consumption.

Benefits of Viking Link

1.4.12 Viking Link can help address the challenges faced by Great Britain and Denmark and can bring many benefits:

- Viking Link will enable more effective use of renewable energy, provide access to sustainable electricity generation and improve security of electricity supplies. Thus it will have socioeconomic benefits for both Denmark and United Kingdom and the wider European community.
- Viking Link is in line with the European Commission's aim for an integrated energy market to ensure value for money for consumers and provides the opportunity to transport renewable energy to centres of consumption.
- Improving diversity and security of energy supply by enabling the import of electricity generated from neighbouring interconnected markets.
- Helping Governments meet carbon reduction commitments by providing access to a well-developed, low cost renewable energy market.
- Lowering the cost of electricity through cross-border trade in electricity and shared use of the cheapest generation sources. This can help consumers in an expensive market to benefit from cheaper imports.
- Increasing market for producers, such as wind power generators – interconnectors increase opportunities to sell electricity, reducing surplus and adding value.

[1] Source: 2030 EU Energy Strategy: https://ec.europa.eu/energy/en/topics/energy-strategy/2030-energy-strategy

- Facilitating competition in the European market and the optimal use of resources across Europe.

1.4.13 Interconnecting Great Britain and Denmark has particular benefits for both countries as follows:

- Denmark is part of the Nord Pool power market and has good links with Sweden, Germany and Norway. For Great Britain, connecting here will provide access to a well-developed, low cost market with prices set by a diversified energy mix from across Scandinavia and Northern Germany.
- For the Danish electricity producers, an interconnector to Great Britain will give access to a high price market and thus increasing the value of intermittent wind generation.
- Viking Link will give Great Britain and Denmark access to a broader energy mix, providing the countries with new opportunities to expand into other electricity markets. The market forces of supply and demand will result in lower prices in peak-consumption periods.
- Wind generation outputs between Great Britain and Denmark show low correlation and periods of high production are unlikely to occur at the same time in both countries. Energy that is surplus to requirements will be transmitted through the interconnector to where the level of demand is higher. This will support the renewable energy markets in both countries, reduce the need to curtail generation during peaks in production and have a beneficial impact on market prices.

1.5 Project of Common Interest in Europe

1.5.1 Viking Link has been included on the European Union List of Projects of Common Interest (PCI). As a PCI, Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure, referred to as the 'TEN-E Regulation' applies to Viking Link, and sits alongside other relevant legislation in each country.

1.5.2 The TEN-E Regulation has been developed to ensure the timely development and interoperability of energy networks in Europe and it sets out guidelines for streamlining the permitting processes for major energy infrastructure projects that contribute to European energy networks.

1.5.3 The PCI process is co-ordinated within each Member State by a National Competent Authority (NCA) and the NCA for each country is as follows:

- UK – Marine Management Organisation (MMO) upon delegation from the Secretary of State for Business, Energy and Industrial Strategy
- Netherlands – Ministry of Economic Affairs (Ministerie van Economische Zaken)
- Germany – Federal Network Agency (Bundesnetzagentur)
- Denmark –Energy Agency (Energistyrelsen)

1.5.4 Each NCA is required to provide the Project with a Permit Granting Schedule which accords to its obligations under the TEN-E Regulation. More information regarding the Project and the TEN-E Regulation is contained within the Viking Link website, with each permit application and supporting documentation submitted to the respective jurisdictions. An environmental assessment supports the applications in each jurisdiction.

2 Permitting and Environmental Assessment

2.1 Project Overview

2.1.1 The connection points for the Project are Bicker Fen in Lincolnshire, Great Britain and Revsing in Jutland, Denmark, and the Project crosses the Exclusive Economic Zones (EEZ) of UK, the Netherlands, Germany and Denmark (see Figure 1).

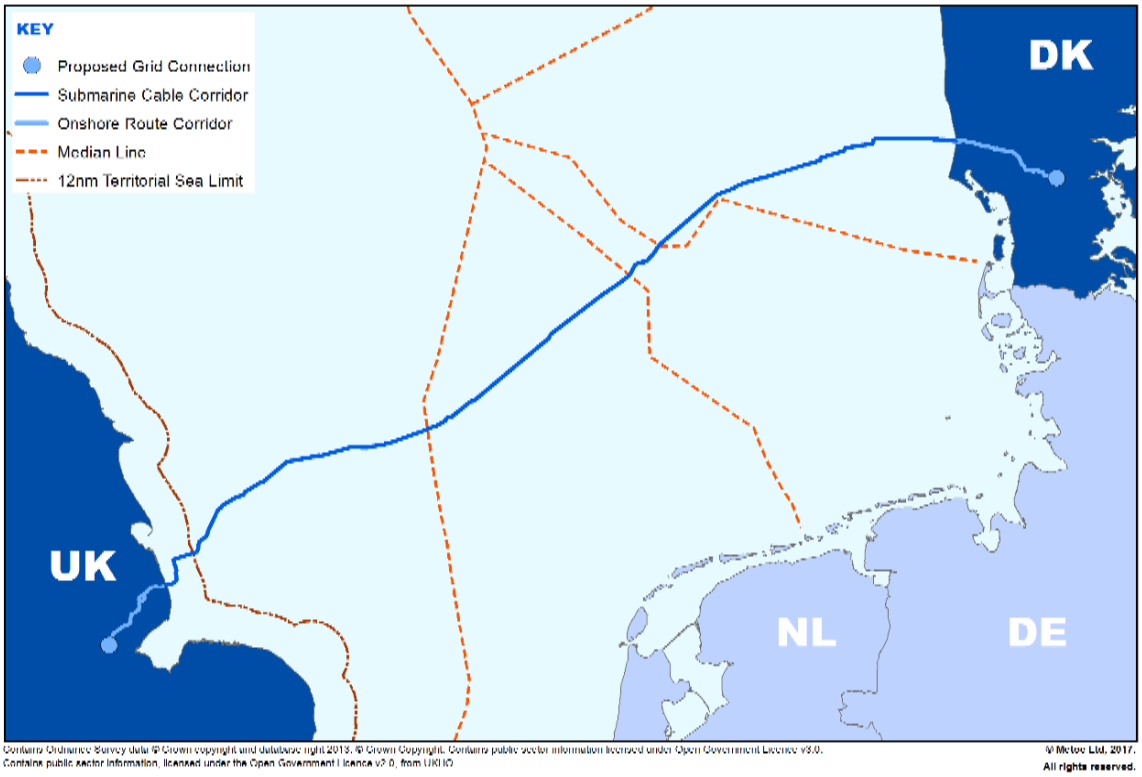

Figure 1 Proposed Cable Route

2.1.2 The high voltage transmission systems in Great Britain and Denmark operate using high voltage Alternating Current (AC). To transport electricity from one country to the other, the AC power is converted to high voltage Direct Current (DC) at a converter station located onshore and transmitted by means of DC cables to the other converter station, whereupon it is converted back from DC to AC for use on the high voltage transmission system.

2.1.3 A direct AC connection between Denmark and Great Britain is not feasible due to the high electrical losses derived from a cable system of this length.

2.1.4 More specifically the Project comprises the following:

- In Denmark:

- New equipment within the existing Revsing 400 kilo Volt (kV) substation and AC cables (Gas Insulated Lines) to connect the existing high voltage electricity transmission network to a new converter station;
- New converter station to change electricity between AC and DC or vice versa depending on direction of operation; and
- Onshore high voltage DC cables from the converter station to the coast in western Denmark.

- In the North Sea (Danish, German, Dutch and UK EEZs):
  - Submarine high voltage DC cables buried in the seabed for as much of their length as practicable;
  - Cable protection material, e.g. rock placement, in areas of harder substrate and pipeline/cable crossing locations.
- In Great Britain
  - Onshore high voltage DC cables from the Lincolnshire coast to a new converter station;
  - New converter station to change electricity between DC and AC or vice versa depending on direction of power flow; and
  - AC cables from the converter station to new equipment within the existing 400 kV Bicker Fen substation which connects to the existing high voltage electricity transmission network.

2.1.5 Figure 2 presents a schematic representation of this configuration.

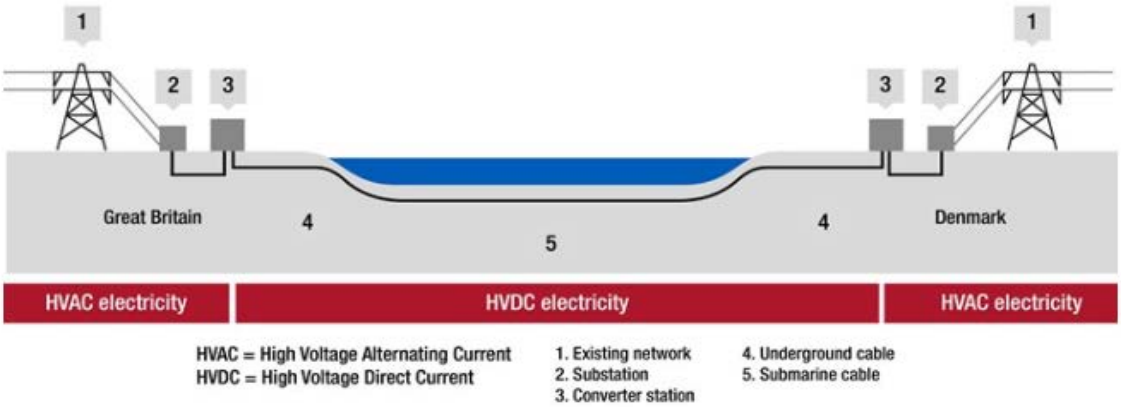

Figure 2 Schematic Overview of Viking Link

2.2 Viking Link Permitting Overview

2.2.1 Permits are required for both onshore and offshore works in Great Britain and Denmark, and for offshore works in the Netherlands and Germany. There are no onshore works in the Netherlands or Germany. The statutory permits for the Project include the following:

- Great Britain
  - Planning Permission under the Town and Country Planning Act 1990 for all elements above Mean Low Water (MLW), i.e. above low tide

- Marine Licence under the Marine and Coastal Access Act 2009 for all elements below Mean High Water Springs (MHWS) to the median line to the Netherlands.

- The Netherlands
  - Water Permit (Watervergunning) under the Water Act 2009.
  - Permit under the Nature Conservation Act 2017 (Wet natuurbescherming)
- Germany
  - Federal Mining Act (Bundesberggesetz) paragraph 133 Section 1 Nr. 1 and 2
- Denmark
  - Planning Permission under the Planning Act 2015 for the converter station (district plan and addendum municipality spatial plan)
  - Environamental Impact Assessment (EIA) permit under the Planning Act 2015 and EIA legislation for the onshore elements.
  - Offshore Installation permit under the Act of Energinet 2011.

2.3 UK Onshore Permit Applications

2.3.1 Planning applications to East Lindsey District Council (ELDC), Boston Borough Council (BBC), North Kesteven District Council (NKDC) and South Holland District Council (SHDC) have been submitted for full planning permission under the provisions of the Town and Country Planning Act 1990 to consent the UK Onshore components of the Project.

2.3.2 An Environmental Statement (ES) for the UK Onshore works has been undertaken by AECOM on behalf of NGVL under the provisions of the Town and Country Planning (Environmental Impact Assessment) Regulations 2011. A single ES covering the whole of the UK Onshore Scheme accompanies each of the four planning applications.

2.3.3 The UK Onshore Scheme components falling within the boundary of each affected Local Planning Authorities (LPAs) are set out below:

- ELDC: The installation of approximately 51.6 km of proposed DC cable and associated temporary works;
- BBC: The installation of approximately 9.78km of proposed underground DC cable, approximately 1.13km of proposed AC underground cable and associated temporary works;
- NKDC: The installation of approximately 4.8km of proposed AC underground cable and associated temporary works; and
- SHDC: The proposed converter station, 2.8km long permanent access road, approximately 0.98km of proposed DC cable, approximately 1.21km of proposed AC underground cable and all associated temporary works.

2.3.4 It should be noted that the land area between the MHWS and MLW is within the jurisdiction of both the Town and Country Planning Act (“onshore permitting process”) and the Marine and Coastal Access Act (“offshore permitting process”)

2.3.5 All four planning applications and supporting documentation were submitted to the individual LPAs on 24th August 2017.

2.4 UK Offshore Permit Application

2.4.1 The offshore works in the UK sector are subject to a consenting regime under the Marine and Coastal Access Act 2009 (MCAA).

2.4.2 As noted above, the submarine cables between MLW and MHWS (the intertidal area) fall under the provisions of both the Town and Country Planning Act 1990 and the Marine and Coastal Access Act 2009.

2.4.3 Under Part 4 of the MCAA the Marine Management Organisation (MMO) is responsible for the licensing of activities related to the construction or removal of any substance or object in English territorial waters (up to 12 nautical miles) and also for such activities where they are undertaken outside of UK territorial waters unless a relevant exemption applies.

2.4.4 An ES for the UK offshore works has been undertaken by Intertek on behalf of NGVL and Energinet. The ES presents the environmental assessment for the submarine cable route within UK waters from the landfall to the UK/NL median line, and accompanies the application under the MCAA.

2.5 Netherlands Offshore Permit Applications

2.5.1 The offshore works in the Dutch sector are subject to permits under the Water Act 2009 and the Nature Conservation Act 2017.

2.5.2 An EIA for the Dutch marine works has been undertaken by Intertek and Witteveen + Bos on behalf of NGVL and Energinet, and supports the permit applications.

2.5.3 There is no terrestrial permit required in the Dutch Sector.

2.6 Germany Offshore Permit Application

2.6.1 The offshore works in the German sector are subject to the permits under the Federal Mining Act (Bundesberggesetz). The authorisation for the laying of a submarine cable is in accordance with paragraph 133 Section 1 Nr. 1 and 2 concerning underwater cables and transit pipelines.

2.6.2 The German authorities have advised that an EIA is not required for the Project. However, an environmental assessment has been undertaken by IfAö on behalf of NGVL and Energinet to support the application files. The Application Files have been submitted to Landesamt für Bergbau, Energie und Geologie (LBEG) submitted to Bundesamt für Seeschifffahrt und Hydrographie (BSH) in March 2017. Feedback has been provided and updated files have been provided for application acceptance.

2.6.3 There is no terrestrial permit required in the German Sector.

2.7 Denmark Offshore Permit Application

2.7.1 The offshore works in the Danish sector are subject to an offshore installation permit under the Act of Energinet 2011 (Paragraph 4a) regulated by the Danish Energy Agency.

2.7.2 The offshore installation permit is not subject to the EIA process however, an environmental assessment has been undertaken by NIRAS on the behalf of NGVL and Energinet to support the permit application.

2.7.3 The Application File for the offshore installation permit under the Act of Energinet 2011 has been submitted to the Energy Agency in March 2017.

2.8 Denmark Onshore Permit Application

2.8.1 The Danish onshore elements are within the remit of the Planning Act 2015 and Planning Permissions are therefore required for the converter station (district plan and addendum to the municipality spatial plan) with the Vejen Municipality as the LPA. Further to this an EIA permit is required under the Planning Act 2015 and EIA legislation of the onshore elements for the converter station and the cable installations regulated by the Environmental Protection Agency.

2.8.2 Proposal for the planning documents (district plan and addendum to the municipality spatial plan) are prepared by the Municipality of Vejen for public consultation and political approval by the end of 2017.

2.8.3 The ES for onshore elements is being issued for public consultation by the Environmental Protection Agency before the final EIA permit can be issued for the Project when the planning permission is ready.

2.9 Habitats Regulations

2.9.1 The Habitats Directive (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 (Directive 2009/147/EC on the conservation of wild birds), the Habitats Directive establishes a network of internationally important sites designated for their ecological status.

2.9.2 The Project passes through four different jurisdictions: UK, Netherlands, Germany and Denmark. Each country is an EU Member State and therefore has a responsibility to implement the EU Directives into their own laws. However, each country has its own interpretation and implementation of the Habitats Directive and the Birds Directive. This network of designated sites known as Natura 2000 sites comprise the following[2]:

- Special Areas of Conservation (SAC) and Sites of Community Importance (SCI): designated under the Habitats Directive to promote the protection of flora, fauna and habitats;

[2] Within the Netherlands all designated sites are referred to as Natura 2000 sites, through the combination of the Habitats and Bird Directive, and are not referred to separately as SACs and SPAs.

- Special Protection Areas (SPA): designated under the Birds Directive to protect rare, vulnerable and migratory birds. The Habitats Regulations incorporate all SPAs into the definition of 'Natura 2000 sites' and as a consequence the protection afforded to Natura 2000 sites under the Habitats Directive applies to SPAs designated under the Birds Directive.
- Ramsar sites: internationally important wetlands designated within the Ramsar Convention (1971) and afforded the same protection as SACs and SPAs within the UK.

2.9.3 A precautionary view of the potential for significant effects to arise on each of the Natura 2000 sites has been performed on a project-wide basis, i.e. from end to end Denmark to the UK. The screening exercise undertaken for Viking Link concluded that no significant effect on any Natura 2000 sites has been identified. The analysis has confirmed that there is no risk to the listed features or conservation objectives of any site.

2.9.4 Other plans, projects and licensable activities have been considered within 10 km of the Project, taking into account the temporal extent of the Project, for a potential in-combination effect on Natura 2000 sites and species. The in-combination screening assessment has considered common receptor pressures with other projects and identified no significant effect.

2.10 Method for Assessment of In-Combination Effects

2.10.1 The consenting regime and environmental assessment of each element has been considered and reported in the separate EIAs. This Bridging Document sets out to summarise the main interfaces of the UK, Dutch, German and Danish environmental assessments and the likely in-combination effects of the Project.

2.10.2 In this context in-combination effects are defined as those effects which have the potential to have an effect on another environment or interface. The assessment of in-combination effects is qualitative and based on professional judgement.

3 Onshore Elements in Denmark

3.1 Denmark Landfall

3.1.1 The location of the Danish landfall for the submarine cable system is near Blaabjerg at the beach Houstrup Strand north of the summerhouse area Henne in Varde.

3.1.2 West of Houstrup Strand is an open beach and high dunes shaped by wind and weather and which continue to be shaped by the dynamic coastal processes such as deposition and clay formation. Behind the dunes is a larger area of heath and Blaabjerg plantation with light-open areas with moor vegetation.

3.1.3 The submarine cables would be pulled from the cable lay vessel onto the beach where the transition joint will be made prior to further horizontal directional drilling (HDD) to pass under the protected sand dunes. The transition joint is proposed to be located onshore, approximately 100 metres from the shoreline.

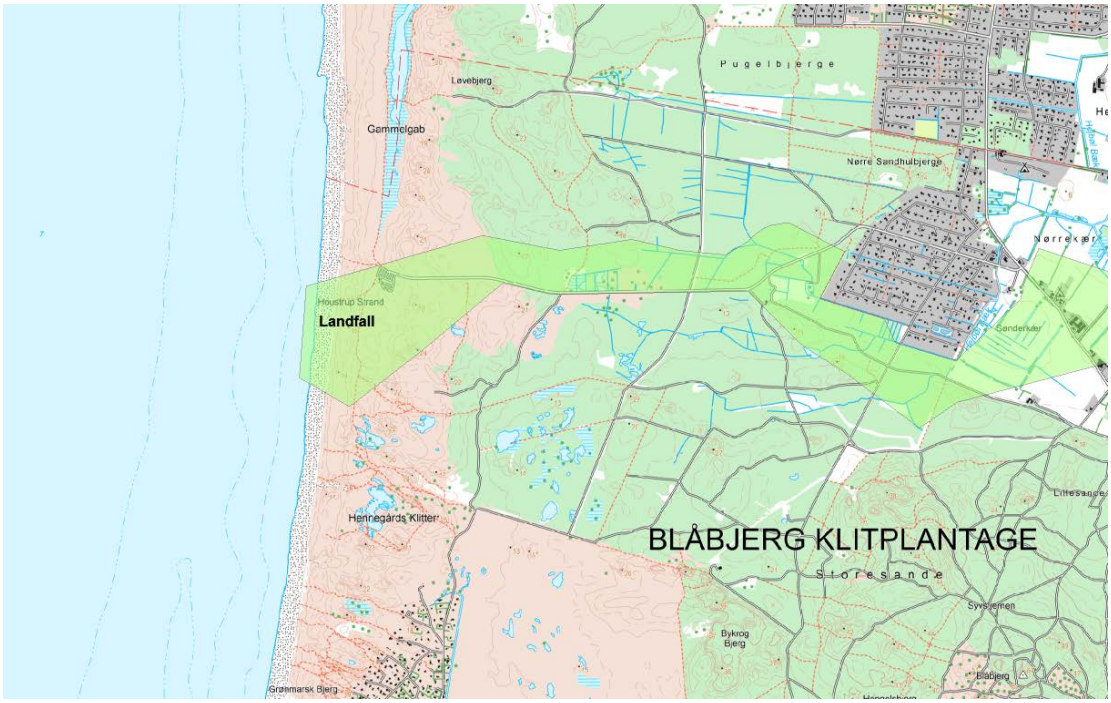

Figure 3 Landfall in Denmark at Blaabjerg

3.2 Cable Corridor

3.2.1 The onshore elements in Denmark have been developed through consideration of potential impacts to the environment and local communities as well as technical considerations. The aim of

this approach is to balance consideration of these factors and identify preferred sites for a landfall and converter station, which is technically feasible and economically viable and which could be brought forward for public consultation.

3.2.2 The preferred cable route corridor between the landfall and converter station in Denmark has been identified by analysing a wide range of constraints including the location of residential areas and spatial planning constraints. The Viking Link team has discussed the options with representatives from local authorities and statutory bodies, and the route corridor has been taken to public consultation in 2016. The overall width of the corridor is approximately 300 m, but may in some areas be both narrower and wider due to constraints. The corridor between Blaabjerg and Revsing is approximately 75 km long.

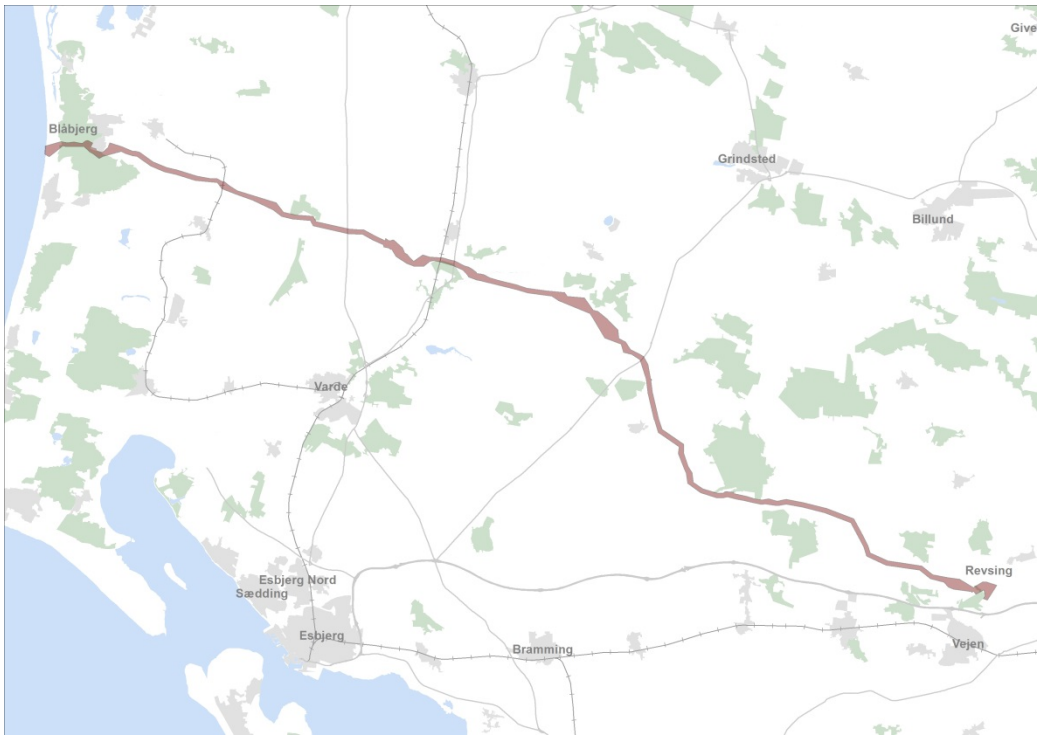

Figure 4 Onshore underground cable corridor in Denmark

3.3 Converter Station, Revsing

3.3.1 At Revsing the area for the converter station includes a land area to the east of the existing substations which is currently agricultural land. The proposal includes both space for the converter station and additional land for use during the construction period for temporary laydown and contractor facilities. The additional land will be used for access and environmental mitigation measures.

3.3.2 Buried high voltage AC cables will connect the converter station to the existing transmission network substations. The high voltage AC connection will be achieved via Gas Insulated Lines within the secured fenced area at the existing substation at Revsing.

3.3.3 The technical elements for the converter station in total are estimated to cover an area measuring 250 x 250 m. The maximum height of some parts of buildings will be up to 24 m above ground. The masts of the overhead lines at the side of the station can be up to 30 m above ground.

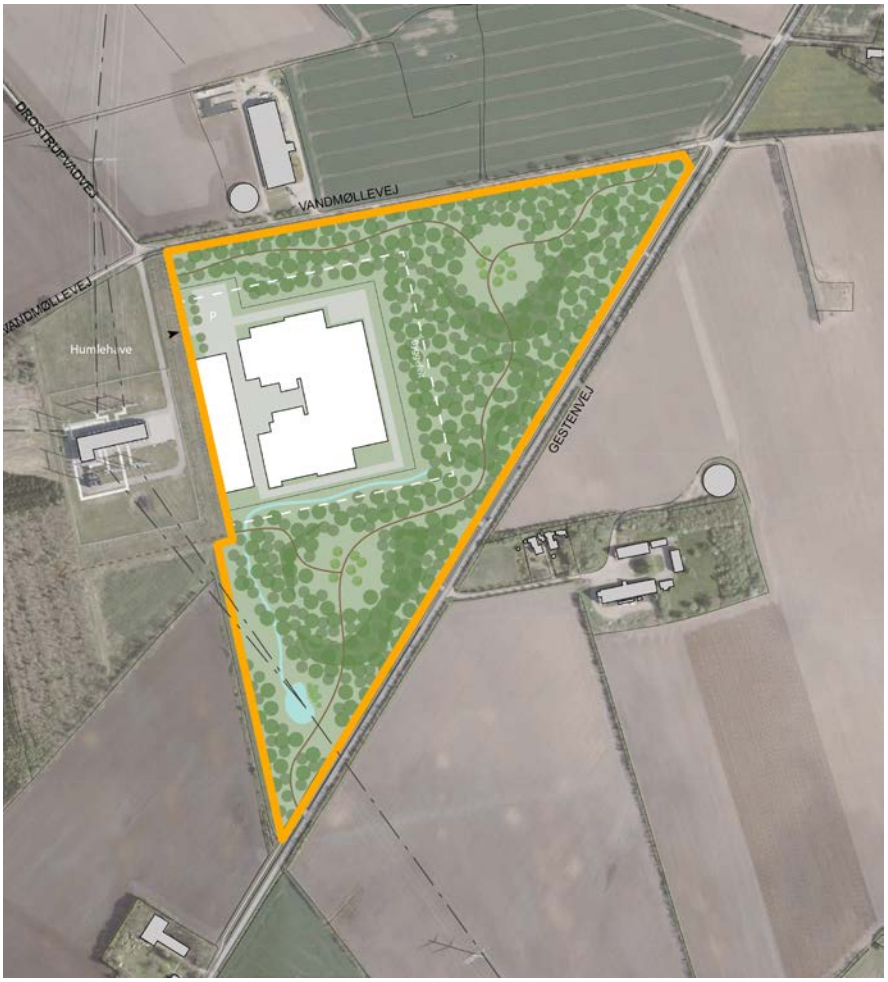

Figure 5 Existing substation (left) and new converter station, Revsing (right)

3.4 Summary of Environmental Effects

Population, health and outdoor life

Construction phase

3.4.1 The potential impacts during the construction phase for the onshore cables are temporary, minor, and can be compared to the impacts from farming activities in the countryside.

3.4.2 During the construction works there may be a need to water the working areas to limit the impacts from dust in the area of the construction activities, especially during dry periods. The need for watering will be assessed on a 'case by case' basis during construction work.

3.4.3 The construction work will generate some temporary noise, but the guidelines for noise levels in Vejen Municipality will be met and therefore the impact on the residents is limited.

3.4.4 In order to allow beach guests to enjoy the beach undisturbed in Blaabjerg near the landfall site, no construction works will be carried out on the beach during the period 1 July to 15 August during the construction seasons. However, during this time it may be necessary to pull the submarine cable onshore, which will take up to 5 working days.

3.4.5 Impacts on outdoor recreation are very minor, and will only be in relation to roads or paths temporarily restricted to traffic.

Operational phase

3.4.6 The new converter station is assessed to have a visual impact on the local residents in the area. The impacts are due to the changes in the characteristic landscape or to the open or flat horizon.

3.4.7 The impact can be mitigated by planting trees and landscaping around the converter site. It has been assessed that the visual impact is thereby reduced, minimising the impact of the local residents and its health.

3.4.8 The magnetic field around the cable is static as the connection is a DC connection. There is no risk to public health from static magnetic fields and the level if the magnetic field is to be compared to the natural magnetic field.

International Nature Conservation

3.4.9 The cable corridor crosses two Natura-2000 areas, respectively in Blaabjerg Plantage and Varde River (the habitat area H72 *Blåbjerg Egekrat, Lyngbos Hede* and *Hennegårds Klitter*, and habitat area H77 *Nørholm Hede, Nørholm Skov* and *Varde Å* east of Varde)

3.4.10 The cable installation will be performed using HDD for both the protected areas and there will be no significant impact on the designated features of the two Natura 2000 sites.

Nature, flora and fauna

3.4.11 The cable corridor is located in the rural environment and various habitats are to be found along the route characteristic for the West Jutland region. The habitats are surrounded by farmland with no significant ecological interests. The converter site is on agriculture land.

3.4.12 Although valuable nature and habitats for rare species are found in many areas within the Project area, the impact of nature, flora and fauna is expected to be avoided with focus in the detailed planning in cooperation with landowners and authorities, using HDD or avoiding protected natural habitats and water streams.

3.4.13 The main impact is related to construction works and is considered to be short-term, temporary and local disturbance of species. Overall, the impact of nature and habitats is not significant.

Protected Annex IV species

3.4.14 A number of highly protected Annex IV species have been identified, which may be affected by the Project.

3.4.15 These are otter, birch mice, nine species of bats, five amphibians, sand lizards, two dragonflies and houting fish. The species are assessed with focus on the potential impact during the construction works for the cable installation. The assessment of the relevant species shows that potential disturbance of the species may occur, but using simple mitigation measures will reduce these impacts, e.g. installing the cables away from pounds and wet areas.

3.4.16 By implementing the mitigation measures, the potential impact of Annex IV species will be minor and the assessments indicate that the Project will not significantly affect the population of the species.

Contaminated soil

3.4.17 There are four areas of contaminated soil of known level 1 and 4 areas with knowledge of level 2. Impacts on these identified sites will be avoided through detailed planning of the cable installation. If necessary to install the cable through a contaminated area, soil management will ensure that the contamination is not released.

3.4.18 The cable route avoids areas which are designated for mining and sand / gravel extraction.

3.4.19 The impact of the Project on soil conditions is generally considered to be not significant.

Groundwater and surface water

3.4.20 The cable corridor crosses a number of streams as well as some areas of special drinking water interests. The converter site is located in an area of special drinking water interest. The Project incorporates a number of safety considerations that minimse the risk of impact on groundwater and surface water areas.

3.4.21 Crossings of watercourses will be undertaken using HDD, and rainwater will be collected in a basin inside the converter station area. Groundwater drainage will only occur very locally and temporarily when needed. It is estimated that construction work and operations will not affect any of these designations for groundwater.

3.4.22 Based on the assessments the impact of groundwater and surface water is considered to be insignificant.

Air and climatic conditions

3.4.23 The Project is a transmission system that does not produce emissions during its operation. Emissions to the air are limited to the construction phase. Emissions to the air originate from the construction phase, and it is estimated that the emissions from this do not represent a significant level.

3.4.24 The emission of greenhouse gases, primarily carbon dioxide (CO_2), is so modest in both construction and operational phase that the direct contribution to climate change is insignificant. The Project will enable higher utilisation and transmission of low carbon energy production, and therefore the Project will indirectly contribute to a reduction in CO_2 emissions.

Noise

3.4.25 The converter station will emit a continuous noise during the operational phase. The Project has built-in shielding which will reduce noise levels to below acceptable limits.

3.4.26 The noise from the construction works (cable installations and converter station construction) is temporary, and as it is concluded that noise values are not exceeded, the environmental impact is not significant.

Materials, Resources and Waste

3.4.27 For the installation of the underground cables and the construction of the new converter station, materials that are used include gravel, concrete, plastic, and metals and some specialist materials. From these materials, some construction waste, packaging from transported material, etc. will be generated. Waste regulations will be followed, and the effects of waste will be minimal and with insignificant environmental impact.

3.4.28 Transportation during the construction phase includes transportation of materials used for cables and converter stations equipment, and is limited and comparable to ordinary goods deliveries. However, there will be transportation of heavy items, e.g. cable drums, which will need approval by local authorities.

3.4.29 The impact from traffic and transportation is considered to be not significant. Transport during operations phase is limited to supervision and maintenance of the converter station with no significant environmental impact.

Landscape and visual conditions

3.4.30 The landscape near the Project area is shaped by the ice age and is characterised by elongated flat hills surrounded by low-lying areas that contain watercourses. The Project area is located in the countryside dominated by agricultural land and dispersed settlements. To the west is the largest coherent nature area in Blaabjerg Plantation with the protected dunes facing the western coastline. Between Blaabjerg and Revsing, there are other protected sites, the largest being at the water streams Varde Å and Holme Å.

3.4.31 The wide landscape is split up by hedgerows, which originate either from settlement relocation or established to reduce sand drift. These hedgerows help to underline the experience of the landscape.

3.4.32 The proposed converter station site is located next to the existing substation at Revsing. In the landscape around the site (within 1 km), the three overhead lines connected to Revsing substation are significant within the landscape, especially the high masts holding the overhead lines being 36 m high and the masts on Revsing substation of 21 m alter the view of the existing landscape.

3.4.33 North of the substation, the area has been designated as a valuable landscape area which the City council in the municipality of Vejen wishes to restrict any new buildings to preserve the landscape.

Visual Impacts

Underground DC cables

3.4.34 The visual impacts of the landscape from the construction work are small and are short-term.

3.4.35 The DC cables are buried, and therefore cannot be seen in the landscape during operation. The landscape is only affected by the small tracks that arise when it will not be possible to avoid clearing forests or hedgerows when crossing them with the cable. By following paths, roads and fences and woodlands where practicable, the impact can be reduced.

Converter station

3.4.36 The assessment shows the construction work does not have a significant impact on the landscape because the Project area is cultivated land without landscape value. The construction work is temporary and the impact therefore stops when the construction work is completed.

3.4.37 During the operations phase the converter station will be dominated by the large valve halls being up to 24 m above ground level.

3.4.38 The visual impact of the landscape from the converter station depends on the distance from which the building is viewed. The visualisations show that the converter station from a distance (greater than 1 km) falls into the landscape and is more or less hidden because the landscape already has buildings and different land use. The figure below shows an example from Drostrupvej viewing the station area. From this angle, within the valuable landscaping area, the converter station is almost hidden by vegetation. The impact on the valuable landscape is more likely to occur from the existing overhead lines in the area.

Figure 6 View of the station area from Drostrupvej, with the station as indicated.

3.4.39 Closer to the converter station (less than 1 km) the view will be dominated by the locations where the converter station appears in the landscape (shown in Figure 7), especially the view from Gestenvej. From the west, Revsing Plantation blocks the view of the station and from the north, the hedgerow along Vandmøllevej has a significant covering effect. The hedgerow along Vandmøllevej will therefore be kept intact.

3.4.40 The impact of the landscape is reduced by locating the converter station in close proximity to the existing substation. The assessment shows that implementing additional mitigation measures may further reduce the impact. As there are no significant landscape interests in this part of the area, the converter station is considered to have a negligible impact on the agricultural landscape to the southeast and east of the power plant. See Figure 7 showing the converter station seen from Gestenvej before planting of trees to reduce the visual impact.

Figure 7 Converter station seen from Gestenvej before planting of trees.

Material good, architectural and archaeological heritage

3.4.41 An archaeological survey will be carried out prior to commencing the construction work, to identify the areas of cultural heritage. The entire Project area will be pre-examined by archaeologists, and any significant ancient monuments or findings will be excavated. If any ancient monuments are found during construction work, the work will be stopped until the authority approves and release the area again.

Socio-economic conditions

3.4.42 The socio-economic impacts from the Project relate to agriculture and tourism. The assessments show the impacts are insignificant. However, mitigation measures are outlined in the Danish ES. In the case of impact to agriculture, appropriate compensation will be paid according to the

disruption on the land. For impact on tourism, no construction will be carried out in the period of 1 July to 15 August in the construction years near the beach in Blaabjerg.

3.4.43 After construction, the project area for the underground cable may return to agricultural use.

Cumulative affects

3.4.44 There are no known projects within the vicinity of the converter site, which will cause cumulative effects on the landscape and visual conditions. It is estimated that there is no need for mitigation measures that will reduce cumulative effects of the Project

Mitigation measures

3.4.45 A number of mitigation measures will be implemented in the construction works and project designs, including:

- In order to allow beach guests to enjoy the beach undisturbed in Blaabjerg near the landfall site, no construction works will be carried out on the beach during the period 1 July to 15 August during the construction years. However, during this time period it may be necessary to pull the submarine cable onshore, which will take up to 5 business days.
- To reduce the visual impact of the converter station, mitigation measures will be implemented using trees and plantation along Gestenvej and to the south of the station area.
- Additional mitigation measures will be introduced to the exterior appearance of the converter station, working with facade cladding and the design of the station, varying the colour scheme, different dimensions etc.
- To prevent the Project from affecting the protected Natura 2000 areas in Blaabjerg Plantation and Varde Å, the crossings will be done using HDD.

4 Onshore Elements in Great Britain

4.1 Overview

4.1.1 Figure 8 illustrates the planning application boundary for the UK Onshore Scheme. This extends across the administrative areas of four LPAs (ELDC, BBC, NKDC and SHDC) and comprises the following:

- At the proposed landfall installation of two (2) submarine high voltage DC cables between MLW and a Transition joint Pit (TJP);
- From the TJP, installation of two (2) onshore DC cables between the landfall at Boygrift and the converter station at North Ing Drove in South Holland;
- Construction of associated Temporary Construction Compounds (TCC) and Temporary Works Areas (TWA) and temporary vehicle access arrangements;
- Erection of converter station buildings and outdoor electrical equipment together with the formation of internal roads and erection of security fencing and formation of landscaping;
- Formation of a permanent access road from the A52 to the converter station site including a bridge crossing of Hammond Beck;
- Installation of up to six (6) onshore high voltage AC cables between the converter station at North Ing Drove and the existing Bicker Fen 400 kV substation;
- Installation of link pillars along the AC cable route for inspection and maintenance purposes, these will be contained within fenced areas;
- Installation of two substation bays at Bicker Fen 400 kV substation to connect Viking Link to the high voltage electricity transmission network;
- Installation of temporary and permanent land drainage works as well as temporary water management areas; and
- Installation of fibre-optic cable(s) with the high voltage AC and DC cables for the purpose of monitoring cable performance.

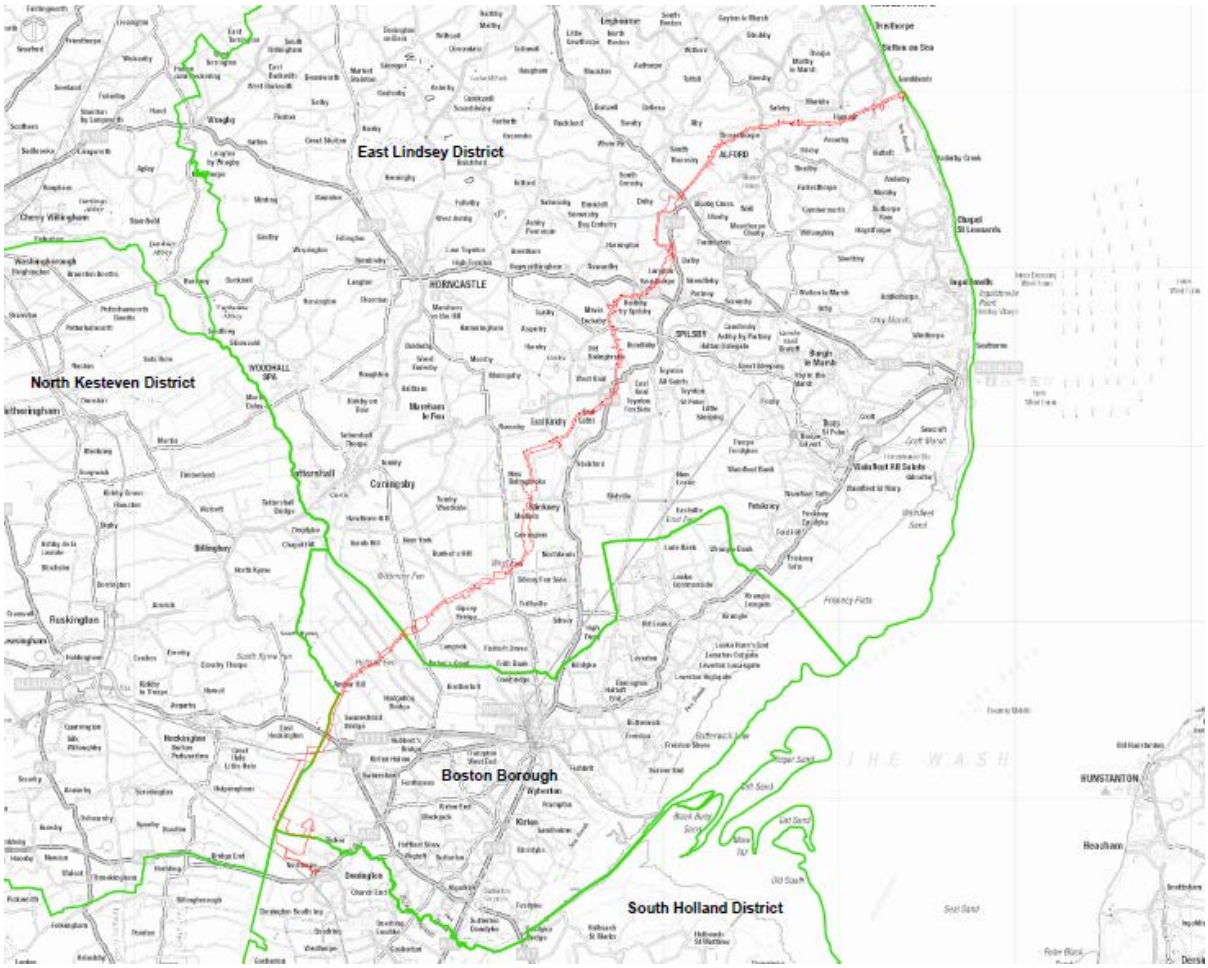

Figure 8 UK Onshore Planning Application Boundary

4.1.2 For the purposes of assessment the UK Onshore Scheme has been split into the following elements:

- Proposed DC cable route.
- Converter station including permanent access road and AC cable

4.1.3 A base scheme design has been developed for the purposes of seeking planning permission. This base scheme design establishes the maximum parameters within which the appointed Contractor will develop and construct the detailed design. The base scheme design comprises:

- For the high voltage DC and AC underground and submarine cables: Limits of Deviation (LoD) have been used which establish the maximum corridor in which underground and submarine cables will be installed whilst providing some flexibility to make minor routeing adjustments should they be required, for example if unforeseen ground conditions are encountered.
- For the converter station: a 'Rochdale Envelope' has been used which establishes the proposed converter station's maximum parameters including the location, layout and

height of buildings and electrical equipment as well as associated development, including perimeter roads, hardstanding areas, drainage and landscape planting.

4.1.4 The EIA of the UK Onshore Scheme has been undertaken in parallel with the development of the base scheme design thereby maximising opportunities to mitigate likely significant effects as they have been identified. This approach ensures mitigation is embedded in the base scheme design and forms an integral component of it.

4.2 Proposed Underground and Submarine Cables

Overview

4.2.1 The planning application boundary of the UK Onshore Scheme starts at the proposed landfall site at Boygrift in East Lindsey. At the proposed landfall site it extends from MLW across the intertidal zone with two submarine high voltage DC cables and one fibre optic cable. These will be installed in ducts below the existing flood defences and terminate at a buried TJP. The TJP will be located inland (west) of the existing flood defences.

4.2.2 From the TJP two underground high voltage DC cables (for transmission of electricity) and up to three fibre optic cables (two for monitoring the performance of the DC cables and one for communications between the proposed converter stations in Great Britain and Denmark) will be installed to the proposed converter station at North Ing Drove in South Holland.

Figure 9 UK Landfall

Proposed Route Description

4.2.3 The total length of the UK Onshore route from the proposed landfall site to the proposed converter station site is approximately 67.16 km.

4.2.4 For the purposes of the EIA the proposed DC cable route has been split into four Route Sections. These are illustrated in Figure 10 to Figure 13, and described from the proposed landfall to the proposed converter station as follows:

- Route Section 1 Proposed landfall to Well High Lane (approximately 13.04 km, entirely within ELDC). This Route Section extends from the proposed landfall site where the UK Offshore Scheme comes ashore at Boygrift, to Well High Lane between South Thoresby and Rigsby. It passes through predominantly flat, low-lying agricultural land.
- Route Section 2 Well High Lane to A16/Keal Road (approximately 16.85 km, entirely within ELDC). This Route Section extends down to Keal Road immediately to the west of East Keal. It extends through the Lincolnshire Wolds Area of Outstanding Natural Beauty

(AONB) and is in an area of more undulating topography with some steeper slopes present.

- Route Section 3 A16/Keal Road to the River Witham (approximately 22.06 km, within ELDC and BBC). This Route Section extends from East Keal to the west of the River Witham northwest of Boston at Langrick. It extends through flat agricultural land crossing a large number of drains, including West Fen Drain.
- Route Section 4 River Witham to the proposed converter station (approximately 15.21 km, within BBC, NKDC and SHDC). This Route Section extends from west of the River Witham and enters the proposed converter station site at its south west corner. It passes through an area of low lying agricultural land and requires numerous drain crossings.

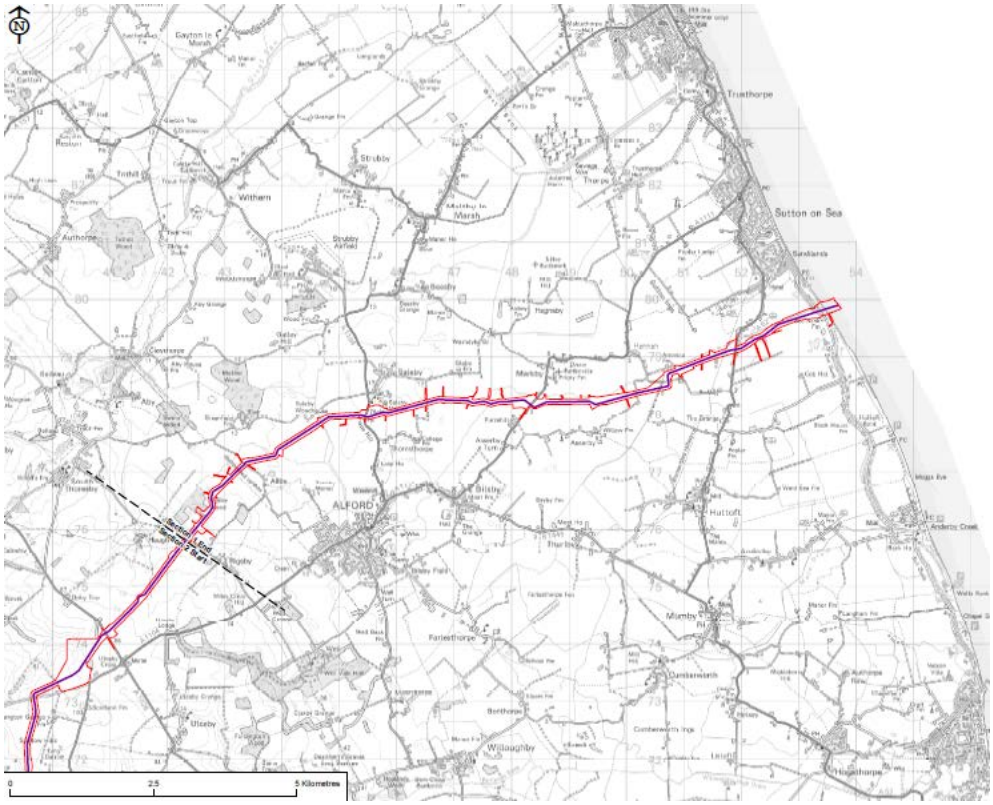

Figure 10 Route Section 1 Planning Application Boundary

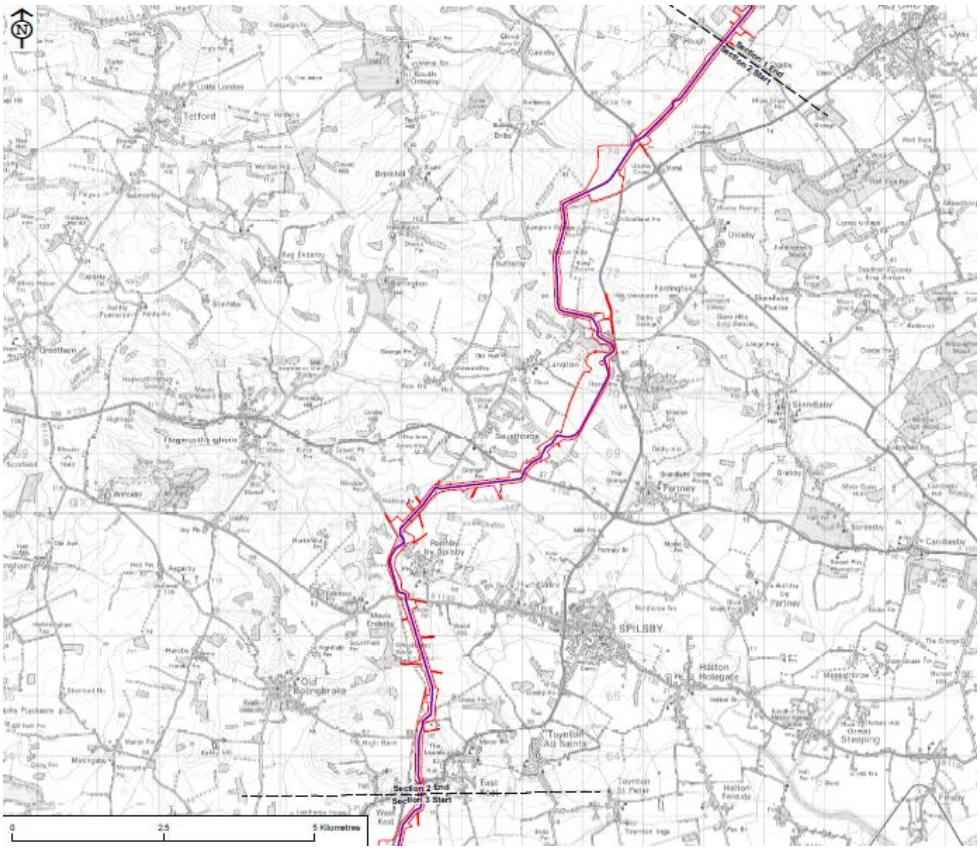

Figure 11 Route Section 2 Planning Application Boundary

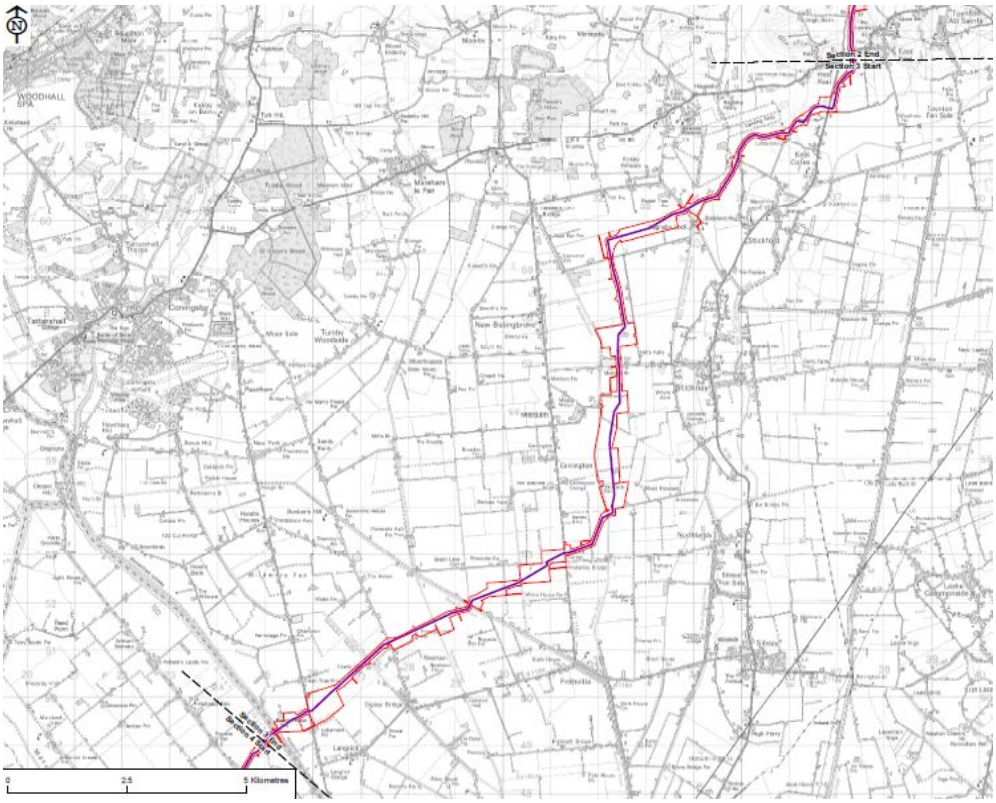

Figure 12 Route Section 3 Planning Application Boundary

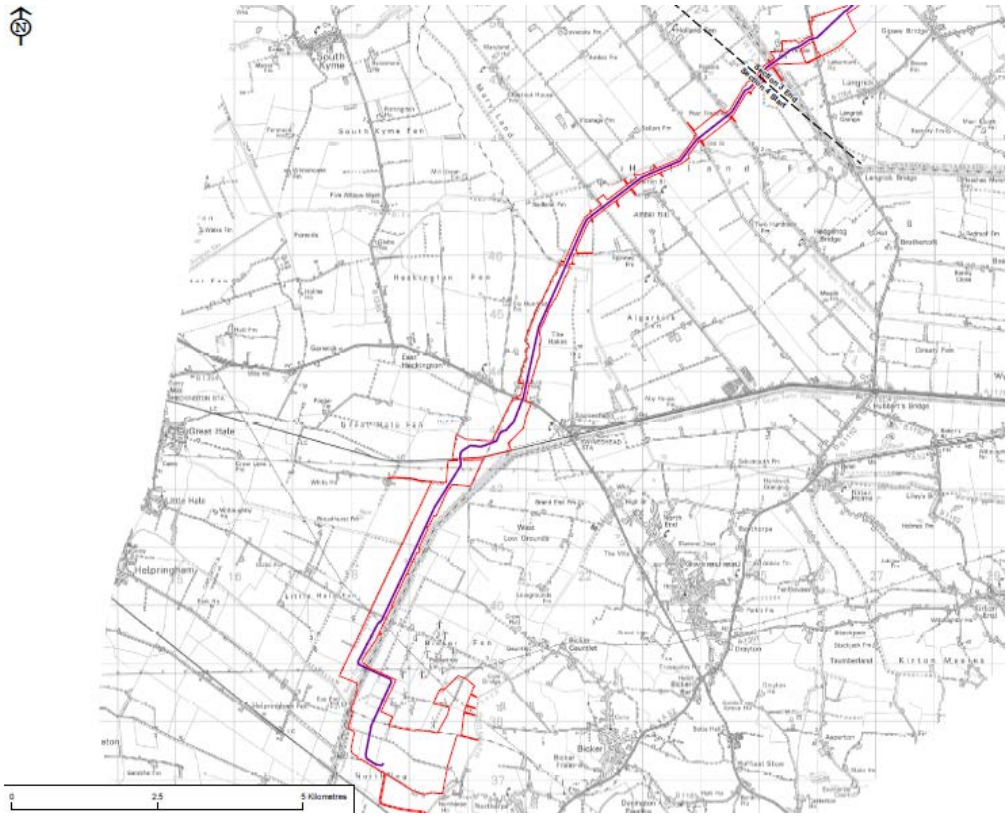

Figure 13 Route Section 4 Planning Application Boundary

Installation

4.2.5 From the proposed landfall to the proposed converter station, the proposed DC cable route is located within a corridor typically 100 m wide (the LoD). Within the LoD a temporary working width typically 30 m wide will be required for cable installation. The working width will comprise:

- One trench approximately 1.5 m wide by 1.5 m deep within which the two DC cables and up to three fibre optic cables will be directly installed or installed within buried ducts.
- A temporary construction haul road, including passing places, to allow movement of construction traffic along the proposed DC cable route within the working width.
- Areas for the temporary storage and management of excavated top-soil and subsoil which will be re-used in reinstating the working width.
- Temporary drainage and water management measures to be implemented during construction.

4.2.6 The proposed DC cable route will be installed by a combination of 'open cut' and 'trenchless' methods. Typically it is anticipated that 'open cut' methods will be utilised in open agricultural land and 'trenchless' methods utilised where the proposed DC cable route crosses obstacles; for example roads, railway lines, buried utilities and watercourses or in areas where ground conditions or environmentally sensitivities are required to be avoided.

4.2.7 In some areas the working width (and hence the LoD) is required to be wider in order to accommodate particular construction activities. This includes locations such as crossings, for example the proposed landfall, watercourses, roads and railways; areas where cable drums may be delivered to; areas of construction difficulty (steep slopes or poor ground conditions) and to allow for the provision of compounds, laydown and storage areas.

4.3 Converter Station, Bicker Fen

4.3.1 The proposed converter station site including associated mitigation and land required for construction occupies a field approximately 30 ha in size and is located at North Ing Drove, South Holland. At the converter station electricity will be converted from DC to AC (or vice versa depending on the direction of operation). The proposed converter station will be connected to the existing high voltage electricity transmission network at Bicker Fen 400 kV substation by approximately 2.34 km of proposed AC underground cable which is routed in a broadly northern direction. Access to the proposed converter station will be provided by a new 2.8 km long permanent access road from the A52.

4.3.2 The proposed converter station site layout is illustrated in Figure 14 and comprises four main zones: building and electrical equipment, perimeter road, hardstanding and security zones. Outside these zones, the proposed site comprises ancillary zones including landscape planting, attenuation, hardstanding and the reinstated zones.

4.3.3 It should be noted that all of the zones are based on the maximum area required to accommodate a converter station and could reduce through the detailed design of the site following appointment of a Contractor.

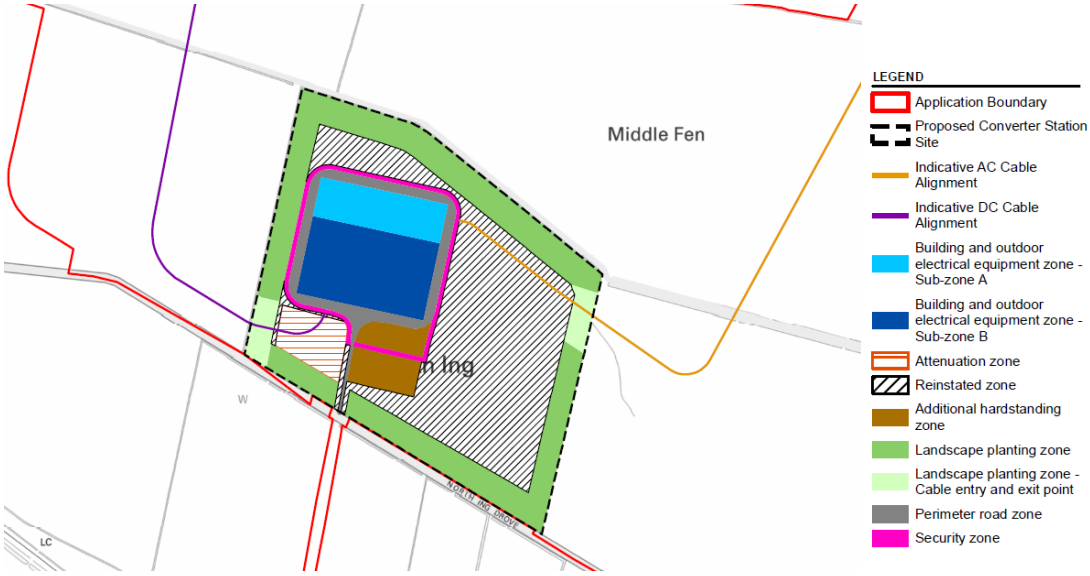

Figure 14 Proposed Converter Station: Base Design Layout

UK Onshore Construction Programme

4.3.4 DC Cable installation is not required to be undertaken sequentially; as a result installation could occur in multiple sections along the route of the proposed DC cable route in parallel. This will limit the extent and duration of construction activity at any given location including the length of time that land remains disturbed for. For the purposes of the EIA it has been assumed that installation of the proposed DC cable route will take between two and three years.

4.3.5 Construction of the proposed converter station, including the permanent access road and AC cable length is planned to be undertaken over a period of 24 to 36 months in parallel with the installation of the DC underground and submarine cables.

4.4 Summary of Environmental Effects

4.4.1 This section provides a high level summary of the technical assessments across all specialists and whether there are determined to be temporary (during construction) and long term or permanent (during operations) significant impacts. Table 1 below identifies all specialist topics where a residual (i.e. taking in to consideration embedded and additional mitigation measures) significant impact has been identified within the assessment. Note that the table will be marked as 'Significant' where only one residual significant impact is noted within either the proposed DC cable route or proposed converter station assessment,

Table 1 Summary of Significant* Impacts				
Specialit Topic	Proposed DC Cable Route		Proposed Converter Station	
	Temporary	Operational and Permanent	Temporary	Operational and Permanent
Geology & Hydrogeology	X	X	X	X
Water Resources & Hydrology	X	X	X	X
Agriculture & Soils	X	X	X	O
Ecology	X	X	X	X
Landscape	X	X	O	O
Visual Amenity	O	X	O	O
Archaeology & Cultural Heritage	X	O	X	O
Socio-economics & Tourism	X	X	X	O
Traffic & Transport	O	X	X	X
Noise & Vibration	O	X	O	X
Cumulative Effects (Intra-Project Effects)	O	X	O	X
Cumulative Effects (Inter-Project Effects)	X	X	O	O

*Key: **X** = No significant impacts recorded; **O** = One or more significant impacts recorded

4.4.3 The table notes that there are six specialist topics that have identified residual significant impacts – Agriculture & Soils, Landscape & Visual Amenity, Archaeology & Cultural Heritage, Socio-economics & Tourism, Traffic & Transport and Noise & Vibration. Of these six, two (Traffic & Transport and Noise and Vibration) record significant residual impacts for the construction phase only.

4.4.4 There are four specialist topic areas that identify significant residual impacts during the operation of the UK Onshore Scheme. Cultural Heritage is the only specialist topic which identifies a permanent significant residual impact associated with the proposed DC Cable Route. It should be noted that it relates to receptors which are located primarily within the planning application boundary for the proposed converter station. The other significant residual impacts relate to the proposed converter station and are limited to receptors either within the footprint of the converter station (Agriculture & Soils), or receptors within the immediate vicinity of the proposed converter

station site (Landscape & Visual Amenity, and Noise & Vibration, and Archaeology and Cultural Heritage).

4.5 Cumulative Effects

4.5.1 The cumulative assessment considered potential impacts from the combined environmental impacts of varying components of the Project (i.e. The UK Offshore Scheme with the UK Onshore Scheme, or the proposed DC cable route with the proposed converter station), and the UK Onshore Scheme in combination with other projects on common or shared receptors. These are referred to as intra-project and inter-projects, respectively.

Intra –Project Effects

4.5.2 Two potential intra-project effects have been identified as a result of the scheme; on land drainage and on the amenity of residents, visitors and recreational users of Public Rights of Ways (PRoWs).

4.5.3 An intra-project effect on land drainage could result from construction of the scheme due to a combination of surface and groundwater impacts. Given the large number of watercourses and drains within the vicinity of the scheme impacts could affect a number of receptors, particularly along the length of the proposed DC route. However these impacts are predicted to be mitigated through the adoption of good construction practices and reinstatement of affected drains, and therefore effects are considered to not be significant.

4.5.4 An intra-project effect on residents, visitors and or recreational users of PRoWs could result from construction of the scheme due to a combination of noise and visual effects leading to a reduction in amenity. Potential receptors are predominantly residential properties or PRoWs in the vicinity of construction works along the full length of the scheme. Construction effects from noise are temporary and intermittent, both through the day and the construction period. In contrast, visual effects will be constant throughout the construction period albeit the magnitude of the effect will change as construction progresses due to the differing equipment in use, and extent of temporary change to land cover. Whilst receptors may experience a cumulative reduction in amenity, they will be short term, temporary and intermittent and therefore when considered in-combination the significance of effects will not increase. As a result , it is predicted that a small number of receptors in close proximity to the scheme (typically within less than 0.5 km) will experience intra-project effects moderate adverse which are therefore significant.

4.5.5 Similarly, potential intra-project effects on residents, visitors and or recreational users of PRoWs could results from reduced amenity during the operation of the scheme from noise and visual impacts. However other than users of the PRoW on North Ing Drove, immediately adjacent to the proposed converter station site would not be significant.

Inter-Project Effects

4.5.6 Screening of projects within the vicinity of the Scheme identified a long list of 66 projects that were known to be proposed or being developed within 1 km of the UK Onshore Scheme. This list was subsequently reduced based on the likelihood of cumulative impacts to occur depending on the type and scale of development, the location of the Project in relation to the UK Onshore Scheme and the development phase the Project is currently in and whether there was likely to be a temporal overlap. From the long list, a short list of 17 projects was defined, of which two were identified to have potential cumulative impacts on shared receptors with the scheme – Heckington Fen Wind Farm and Triton Knoll Electrical System.

4.6 Conclusions

4.6.1 The EIA of the UK Onshore Scheme has identified and assessed the likely significant effects which would result from its construction and operation. Through careful siting and routeing as well as embedding mitigation within the base scheme design, NGVL has prevented or reduced a number of potentially significant environmental effects. However, given the scale of the UK Onshore Scheme some significant environmental effects are unavoidable and as such some will remain following mitigation. The majority of significant environmental effects will occur during construction of the UK Onshore Scheme and whilst significant they will be temporary lasting for the duration of construction works only. Where significant environmental effects are predicted to be permanent these relate to above ground components of the Scheme (the proposed converter station and the permanent access road).

4.6.2 The proposed DC cable route is not predicted to result in significant environmental effects in the long term. Significant environmental effects are predicted to occur during construction only. This includes effects on residents and visitors in proximity of the proposed DC cable route who may experience significant noise and/or visual effects as well as some roads which will be used during construction where predicted increases in traffic flows as a result of construction traffic are likely to be significant. However, it should be noted that whilst some significant environmental effects are predicted these will not occur along the full length of the proposed route for the full duration of construction but rather for short periods of time whilst the proposed route is constructed in sections.

4.6.3 The proposed converter station is predicted to result in temporary and permanent significant environmental effects. Temporary significant effects are predicted on landscape character and visual amenity in the immediate vicinity as result of construction activity. Permanent effects on landscape character and visual amenity have been mitigated as far as possible through the inclusion of landscape planting within the base scheme design including extensive tree planting around the perimeter of the proposed site, however, significant effects will remain. Permanent significant effects are also predicted as a result of:

- Physical impacts on heritage receptors within the proposed converter station site; these have been mitigated as far as possible through commitments to pre-construction investigation and recording of heritage receptors.
- The permanent loss of Best and Most Versatile (BMV) agricultural land as a result of the proposed converter station's permanent land take. Whilst over 20 hectares (ha) will be lost the assessment notes a considerable amount of land in the region is classed as BMV.
- The permanent impact on a PRoW which crosses the permanent access road. Whilst usage of the PRoW is low in the worst case this it would be stopped up and with a permanent diversion provided to offset this.

4.6.4 NGVL has incorporated the majority of mitigation measures within the base scheme design for which planning permission is being sought as well as committed to the implementation of various measures during construction. Should planning permission for the UK Onshore Scheme be granted, NGVL are committed to working with their appointed Contractor(s) to reduce the Scheme's environmental effects as far as practicable in finalising the detailed scheme design and undertaking construction works. This approach will ensure that the actual effects of the UK Onshore Scheme would be no greater than the likely effects identified and assessed in the ES.

5 Submarine Cable Corridor

5.1 Route Overview

5.1.1 The route derived from preliminary cable route engineering and survey is shown in Figure 15. Kilometre points (KPs) have been assigned to the route running from 0 at the Danish coast. The total length and width of the submarine cable corridor within each territory is shown below in Table 2.

Table 2 Submarine cable corridor length and width by jurisdiction

Territory	Submarine Cable Corridor Length (Km)	Submarine Cable Corridor Width (m)
Danish Sector	215 km	450 m
German Sector	30 km	450 m
Dutch Sector	170 km	450 m
UK Sector	220 km	450m increasing to: 900m between KP474 – KP476.5; 1130m between KP567.5 – KP572.5; and 575m between KP615.6 and MHWS.

5.1.2 It should be noted that although the submarine cable corridor (for within which consent for installation of the submarine cables will be applied for) is generally 450m wide (1130m at widest point in UK sector between KP 567.5 and 572.5), the final cable configuration will need only a small part of this width for installation.

5.1.3 It is proposed to finalise the precise position of the submarine cables within the corridor after permits are granted but before installation has commenced. This will allow for optimisation of the final installed submarine cables to minimise engineering and environmental challenges, including such factors as avoiding:

- Unexploded ordnance (UXO).
- Boulders.
- Undulations such as troughs and ridges.
- Mobile seabed features such as sand waves.
- Areas of hard soils or gravels.
- Steep slopes.
- Any debris not removed prior to installation.
- Abandoned well heads and 'spudcan' (inverted cones mounted at the base of oil and gas drilling platforms) indentations.
- Other magnetic anomalies.

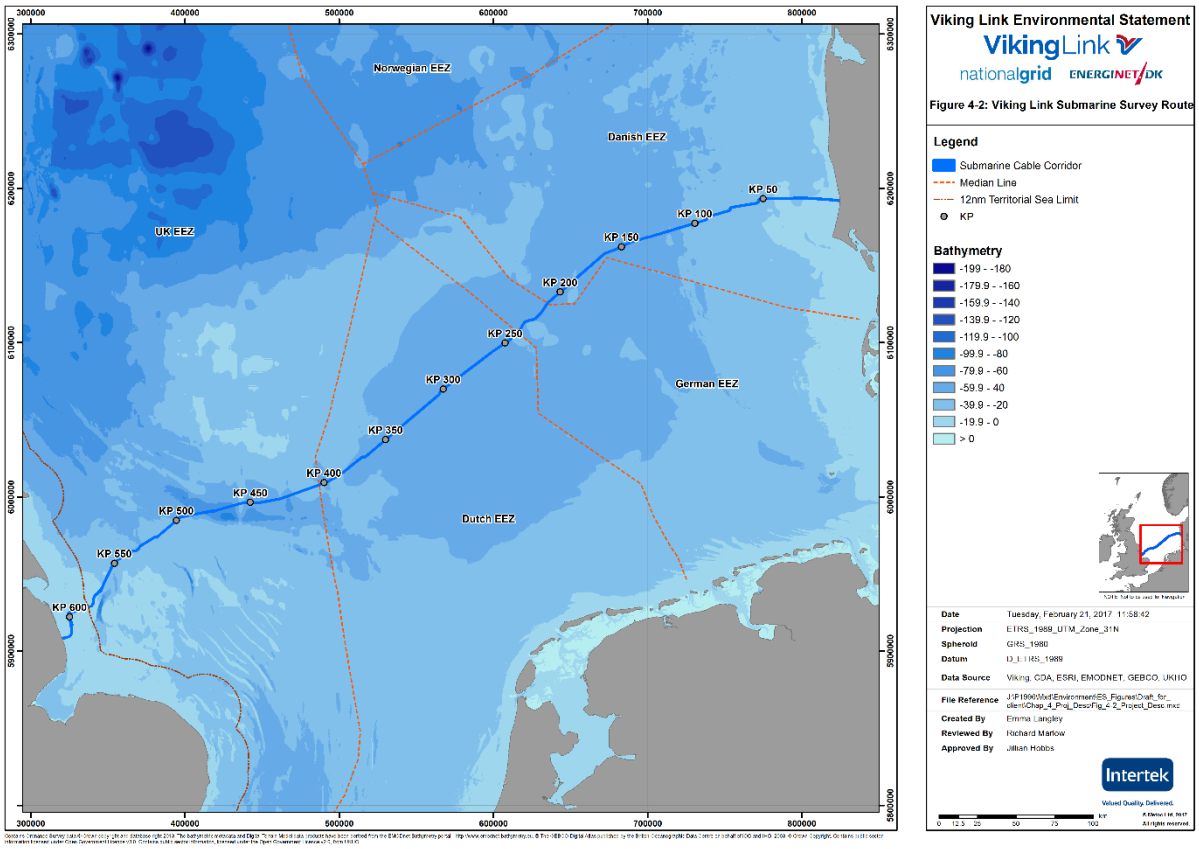

Figure 15 Submarine Cable Corridor

5.2 Submarine Cables

5.2.1 Electricity will be transmitted using high voltage DC submarine cable technology. There are currently two types of high voltage DC submarine cable available. These will be of either Extruded or Mass Impregnated Non-Draining (MIND) insulation technology (see Figure 16). Typically, these cables are around 150mm in diameter and will operate at a voltage of +/- 525kV. The basic design of the cables is similar with the main difference being the type of insulation used.

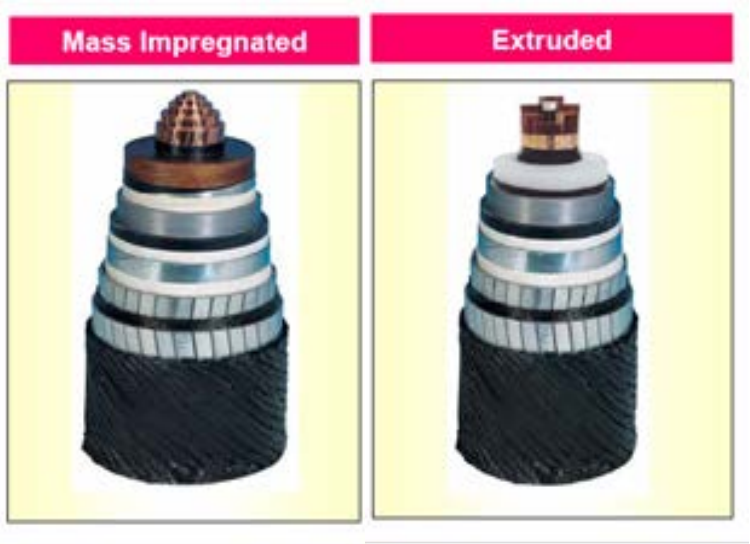

Figure 16 Indicative Submarine HVDC Cable Options

5.2.2 The cable lay configurations proposed for each jurisdiction are presented below in Table 3.

Table 3 Cable configuration for each jurisdiction

Term	UK Sector	Netherland Sector	German Sector	Danish Sector
High voltage DC Cable Installation	Either laid as a single operation or separately. Cables will be either in the same trench or up to 50m apart	Either laid as a single operation or separately but in same trench	Either laid as a single operation or separately but in same trench	Either laid as a single operation or separately. Cables will be either in the same trench or up to 50m apart
Fibre Optic Cable Installation	May be installed at the same time as DC bundled cables	May be installed at the same time as DC bundled cables	May be installed at the same time as DC bundled cables	May be installed at the same time as DC bundled cables
Cable Joints	Between 12 and 30 submarine cable joints along the entire submarine route			

Table 3 Cable configuration for each jurisdiction				
Term	**UK Sector**	**Netherland Sector**	**German Sector**	**Danish Sector**
Repeater for the Fibre Optic Cable	To be placed along the cable route approximately every 150 km next to a cable joint in order to extend optical signal (not in Klaver Bank in the Dutch Sector)			

5.2.3 The cable installation operation will be performed on a 24-hour basis to ensure minimal navigational impact on other marine users and to maximise the efficient use of suitable weather conditions and vessel and equipment time. Notifications will be issued in accordance with the statutory procedures to ensure navigational and operational safety. In addition to the installation vessel(s), additional vessels (i.e. guard vessels) may be involved with the operation.

5.2.4 Typical vessels used in the installation are shown below in Figure 17.

Figure 17 Typical cable lay vessels

5.2.5 The cables are laid and buried at the same time, or an additional vessel is used to bury the cable as shown below in Figure 18.

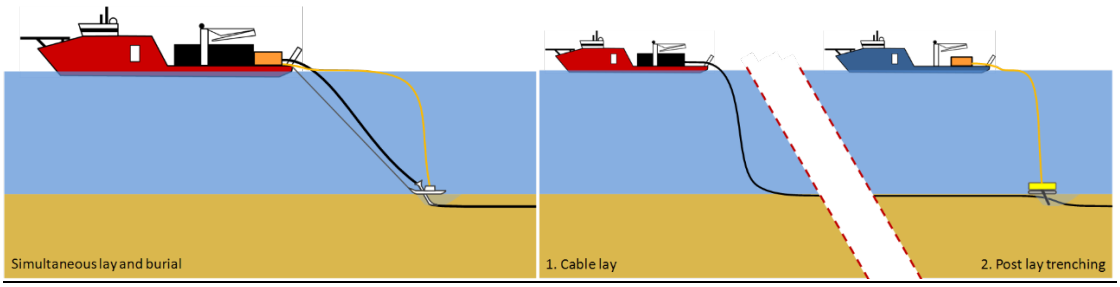

Figure 18 Submarine Cable Laying Options

5.3 Summary of Environmental Effects – UK Sector

Boygrift Landfall

5.3.1 The beach at the Boygrift landfall is considered to be tolerant to changes in morphology and the intertidal works will be localised, relatively short term and temporary. NGVL will remain in close liaison with the Environment Agency regarding development of the proposals and interaction with the Lincshore Renourishment Scheme. Effects on the morphology of the beach at Boygrift landfall have been assessed as **Not Significant.**

5.3.2 Boygrift landfall is a popular beach during summer months. The duration of installation works on the beach will be minimised as much as practicable. Work areas will be appropriately demarcated and warning signs will be erected. Installation will not have a significant effect on beach users due to its temporary, short term and localised nature.

5.3.3 There will be temporary, short term intertidal habitat loss and disturbance at the landfall as a consequence of cable installation. Excavated material will be replaced after cable installation and the beach profile will be restored to facilitate the recovery of intertidal habitats. The Boygrift landfall lies within the Lincs Belt recommended Marine Conservation Zone (rMCZ). However, no species or habitats of conservation interest/importance were observed during the Phase 1 intertidal walkover survey. The intertidal habitats are subject to high levels of natural abrasion and continued habitat disturbance. The species present can withstand some physical disturbance and/or recover rapidly and the effect of disturbance is considered **Not Significant**.

Water Quality

5.3.4 There are two bathing water sites, Moggs Eye and Sutton-on-Sea, each side of the Boygrift landfall. Changes in water quality resulting from sediment plumes during submarine cable installation, maintenance and repair or decommissioning will be within the normal variances, limited in extent and will not have a significant effect on bathing water quality or water quality in general. The effect on water quality is **Not Significant**.

Protected Sites

5.3.5 The UK Offshore EIA assessed all protected sites with marine components within 10km of the submarine cable corridor and selected sites greater than 10km because they are important for mobile species, e.g. marine birds, and marine mammals. Of particular note, the submarine cable corridor passes through four protected sites:

- Greater Wash potential Special Protection Area (pSPA). This site is proposed for the protection of over-wintering red-throated diver, little gull and common scoter; and breeding Sandwich tern, little tern and common tern.
- Southern North Sea candidate Special Area of Conservation (cSAC). This site is proposed for the protection of harbour porpoise.

- Holderness Offshore recommended Marine Conservation Zone (rMCZ). The features recommended for designation include two broad scale habitats (subtidal coarse sediment and subtidal mixed sediment).
- Lincs Belt rMCZ. The features recommended for designation include two broad scale habitats (subtidal coarse sediment, subtidal sand, subtidal mixed sediments) and two habitat features of conservation interest (peat and clay exposures and subtidal sands and gravels).

5.3.6 The UK Offshore EIA concluded that the Project will not adversely affect the integrity or the conservation objectives of any of the sites. The effects on protected sites are therefore **Not Significant**. This conclusion is supported by a Natura 2000 Screening Assessment and a Report to Inform MCZ Screening.

Benthic Ecology

5.3.7 The marine survey identified 12 individual EUNIS habitats and two biotope mosaics along the submarine cable corridor. 22 sites were investigated as they showed a resemblance to either biogenic or rocky reef (EC Habitats Directive Annex I listed habitats). Of these sites 11 were classified as showing low resemblance to stony reef, the remainder were not classified as reef features. Impacts on benthic habitats from seabed disturbance will be temporary during submarine cable installation, maintenance and repair, and decommissioning and **Not Significant.**

5.3.8 The submarine cable corridor passes through an area that has been classified as a blue mussel (Mytilus edulis) bed, a UK Biodiversity Action Plan Priority Habitat; but does not constitute an EC Habitats Directive Annex I biogenic reef. The effect of seabed disturbance from cable installation, maintenance and repair and decommissioning on this habitat has been assessed as minor. The application of Project specific mitigation, e.g. micro-routeing to avoid the more sensitive areas of the seabed, will further reduce the residual effect. The effect on the blue mussel beds has been assessed as **Not Significant.**

Fish and Shellfish

5.3.9 The submarine cable corridor passes through the spawning and nursery grounds for 15 species of fish of commercial or conservation importance. The area is also important for shellfish species such as brown crabs, Norway lobster, whelks and brown shrimp. Species listed on Annex II of the EC Habitats Directive may be present in the submarine cable corridor, including sea lamprey, river lamprey and European eel.

5.3.10 Species with demersal life stages (herring, sandeel and rays) have been identified as particularly sensitive to activities which disturb the seabed, e.g. during cable installation, maintenance and repair and decommissioning. A Sandeel and Herring Impact Assessment (Technical Appendix F) was undertaken to inform the EIA. The assessment identified areas of suitable sandeel habitat within the submarine cable corridor for approximately 62km. It also concluded that herring do not regularly spawn within the submarine cable corridor. However as functional habitat is available,

herring may return to previously abandoned areas. The EIA concluded that the effect of seabed disturbance on species with demersal life stages is minor and **Not Significant.**

5.3.11 The Project will generate underwater noise during submarine cable installation, maintenance and repair and decommissioning which has the potential to cause short term, temporary and minor disturbance effects to fish. This will only affect individual animals and as such will not affect population or stock viability.

Marine Birds

9.7.1 Sensitive marine bird species which could be affected by the Project include:

- Over wintering red-throated diver, little gull and common scoter; and breeding little tern, common tern and Sandwich tern from the Greater Wash pSPA.
- Little tern from Humber Estuary SPA and Gibraltar Point SPA.
- Little tern and common tern from The Wash SPA.
- Qualifying species of Flamborough Head & Bempton Cliffs SPA and Flamborough and Filey Coast pSPA.

5.3.12 The presence of Project vessels has the potential to disturb these birds, however the findings of the UK Offshore EIA indicated most species did not forage as far as the submarine cable corridor or were not sensitive to disturbance from vessels. The UK Offshore EIA concluded that the effect on marine birds would be negligible and **Not Significant.**

Marine Mammals and Marine Reptiles

5.3.13 Seven species of cetacean (whales, dolphins and porpoises) and two species of pinniped (seals) occur regularly over large parts of the North Sea and within the vicinity of the Project. All cetaceans are European Protected Species. In addition the submarine cable corridor passes through the Southern North Sea cSAC which is designated for the protection of harbour porpoise and is within close proximity to The Humber Estuary SAC (9km) designated for the protection of grey seal and The Wash and North Norfolk Coast SAC (14.5km) designated for the protection of common seal.

5.3.14 The Project will generate underwater noise during submarine cable installation, maintenance and repair and decommissioning which has the potential to cause physical injury (although unlikely), and short term, temporary disturbance effects to marine mammals. The effects of underwater noise (disturbance in particular) from the geophysical survey and from UXO detonation were assessed as moderate and therefore significant. However, the implementation of the JNCC Best Practice guidelines will reduce residual effects to minor which is considered **Not Significant**.

5.3.15 A minor, localised, but long-term effect from electromagnetic fields will be caused during operation of the submarine cables. Whilst marine mammal species are sensitive to electromagnetic fields no impacts on prey location, navigation or migration patterns are expected and the effect has been assessed as **Not Significant**.

Navigation Safety

5.3.16 The UK Offshore EIA identified three aspects of the Project which have the potential to effect navigation safety for commercial shipping, commercial fishing and recreational boating.

Temporary disruption

5.3.17 The presence of Project vessels will cause temporary disruption to shipping, fishing and recreation activity in the vicinity of the submarine cable corridor. Disruption will be limited to discrete sections of the submarine cable corridor, confined to the location of the maintenance or repair activity, or progressing along the submarine cable corridor during installation and decommissioning. Procedures to minimise disruption near high density shipping areas will be developed and implemented. Notice will be given to sea users in the area via Notices to Mariners, Kingfisher Bulletins, NAVTEX, and NAVAREA warnings. The effect has been assessed as **Not Significant.**

Reduction in water depth

5.3.18 The intention is to bury the cables in the sediment as far as possible. However, it has been identified that burial in sediment may not be feasible for up to 29 km of the submarine cable route. Where the required burial depth cannot be achieved, the use of rock protection over the cables will be required. Rock berms will also be required to facilitate the crossing of existing cables and pipelines. In water depths of less than 20m the application of rock has the potential to reduce chart datum by more than 5%; posing a potential risk to navigation. The potential effect on navigation has been assessed as moderate and is therefore significant and requires mitigation. Prior to cable installation, the Project will conduct a risk assessment, in consultation with the Maritime and Coastguard Agency, on any areas along the submarine cable corridor where there is potential for navigable water depth to be reduced by cable protection measures. This will reduce the residual effect to minor and **Not Significant.**

5.3.19 It is recognised that rock berms pose a snagging hazard to commercial fishing. Rock berms will be designed to be over-trawlable. A cable burial plan will be produced which will outline proposed method statements and cable protection requirements for approval by the Regulator and will inform discussion with fisheries stakeholders. A Fisheries Liaison Officer (FLO) will be appointed by the Project to ensure effective communication between the Project and fisheries stakeholders.

Compass deviation

5.3.20 A minor, localised, but long-term effect from electromagnetic fields (EMF) will be caused during operation of the submarine cables. This will cause a minor effect on the magnetic compasses of ships, fishing boats and recreational craft as they pass directly over the submarine cables. The

level of deviation at the sea surface will vary according to cable configuration, alignment with the Earth's natural magnetic field at the installation location, and water depth. Few modern vessels depend solely on magnetic compasses but they may still be used as an auxiliary and it is possible that the EMF could cause a detectable change in direction of the vessel if using autopilot. The UK Offshore EIA concluded that this could potentially be a moderate effect on recreational craft if the cables are laid separately. Any reported or recorded compass deviations will be reported to the UKHO and charted as appropriate. This will reduce the residual effect to minor and **Not Significant.**

Infrastructure and Other Sea Users

5.3.21 The submarine cable corridor passes through the Hornsea Project Four Offshore Wind Farm area. Close communications with DONG Energy will be maintained to ensure both parties can work together to enter into commercial and consenting arrangements to govern shared use of the area at the relevant times.

5.3.22 Following consultation with Tarmac Marine Limited, the installation corridor has been widened to allow the submarine cables to be installed at a further distance from the Humber Overfalls marine aggregate site. There is still the potential that if marine aggregate extraction is active in the licence area during cable installation, Tarmac Marine Limited could experience temporary and short-term disruption to their operations. Communications will be maintained to ensure all potential disruption is minimised and is **Not Significant.**

Marine Archaeology

5.3.23 Three wrecks were identified within the submarine cable corridor. These will all be subject to archaeological exclusion zones during installation.

5.3.24 Provided the appropriate mitigation is followed (e.g. Protocol for Archaeological Discovery, Written Scheme of Investigation) the effects of the Project on marine archaeology will be **Not Significant.**

Cumulative Effects

5.3.25 The assessment has identified that Potential Cumulative Effects (PCE) could result from interactions between the Project and other plans, projects and licensed activities. For the most part these have been assessed as negligible. Of note, the Project crosses the shared Hornsea Project One and Two export cable corridor. The crossing could result in a minor PCE to shipping and commercial fisheries as water depth is reduced at the crossing location. There is also the potential for a minor PCE to fish and shellfish as the seabed will be disturbed on two separate occasions. Both PCEs are minor and **Not Significant**.

5.4 Summary of Environmental Effects – Dutch Sector

Assessment scoring system

5.4.1 The identified potential impacts are rated following a five-scale scoring system as outlined in Table 4. The final assessment of the impact can be either positive (+), neutral (0) or negative (-) and has been included within each specialist impact section. In applying this approach, expert judgment, informed by reference to legal standards, government policy, current good practice and the views of stakeholders, has been used to produce a final score.

5.4.2 For the purposes of the EIA, an impact that leads to a strong negative impact or norm exceedance requires mitigation to reduce the impact if possible. Small negative impacts or small norm exceedances or impacts that do not alter the reference situation are not considered to cause a significant impact and normally mitigation is not suggested.

Table 4 Assessment scoring system

Scoring	Assessment compared to the reference situation*
--	Viking Link leads to a strong negative impact or strong norm exceedance
-	Viking Link leads to a small negative impact or small norm exceedance
0	Viking Link does not alter the reference situation
+	Viking Link leads to a small positive impact
++	Viking Link leads to a strong positive impact

5.4.3 Table 5 provides a summary of the impact assessment.

Table 5 Summary of the impact assessment

Environmental Theme	Potential Impact	Score (--, -, 0, +, ++)
Physical environment and hydrology		
Installation and decommissioning	Increase in suspended sediment	0
	Disturbance of contaminate sediments	0
	Disturbance/damage of seabed morphological features	0
	Damage to protected geological features	0
	Modification of sediment transport pathways	0
Operation (including	Modification of sediment transport pathways	0

Table 5 Summary of the impact assessment		
Environmental Theme	**Potential Impact**	**Score (--, -, 0, +, ++)**
maintenance and repair)	Secondary scour within the vicinity of any cable protection	0
Natura 2000 sites and national designations		
Natura 2000 sites and national designations		
Klaverbank SCI	Annex I habitat - reefs	-
	Annex II Marine Mammals - harbour porpoise, grey seal, harbour seal	-
Doggerbank SCI	Annex I habitat - sandbanks	-
	Annex II Marine Mammals - harbour porpoise, grey seal, harbour seal	-
Centrale Oestergronden	Seabed ecosystem	-
Benthic Ecology		
Installation and decommissioning	Permanent loss of habitat	0
	Temporary habitat disturbance	-
	Temporary physical disturbance, abrasion and/or crushing	-
	Temporary increase in suspended sediment and smothering	0
	Temporary disturbance to contaminated sediments	0
	Temporary indirect effect to prey species	0
	Hydrocarbon or chemical spills	0
Operation (including maintenance and repair)	Permanent disruption caused by electromagnetic fields	0
	Permanent disruption caused by heat emissions	0
	Effect of temporary maintenance and repair activities	0
Fish and Shellfish Ecology		
Installation (and decommissioning)	Permanent loss of habitat	0
	Temporary habitat disturbance	0
	Temporary physical disturbance, abrasion and/or crushing	0
	Temporary increase in suspended sediment and	0

Table 5 Summary of the impact assessment			
Environmental Theme	**Potential Impact**		**Score (--, -, 0, +, ++)**
	smothering		
	Disturbance to contaminated sediments		0
	Temporary underwater noise		0
	Temporary indirect effect to prey species		0
	Hydrocarbon or chemical spills		0
Operation (including maintenance and repair)	Permanent disruption caused by electromagnetic fields		0
	Permanent disruption caused by heat emissions		0
	Effect of temporary maintenance and repair activities		0
Marine mammals			
Installation and decommissioning	Temporary underwater noise	Installation activities	0
		Geo-physical surveys - Disturbance	-
		Geo-physical surveys - Injury	0
		UXO clearance - Injury	-
	Temporary collision risk		0
	Temporary indirect effects to prey resources		0
	Temporary hydrocarbon or chemical spills		0
	Temporary disturbance to contaminated sediment		0
Operation (including maintenance and repair)	Permanent disruption caused by electromagnetic fields		0
	Effect of temporary maintenance and repair activities		0
Marine Birds			
Installation (and decommissioning)	Direct temporary habitat loss/disturbance		0
	Indirect temporary habitat loss/ disturbance		0
	Accidental pollution		0
	Permanent habitat loss /disturbance		0
Operation (including maintenance and repair)	Effect of temporary maintenance and repair activities		0
Archaeology			
Installation (and	Damage/destruction to sites/ artefacts		0

Table 5 Summary of the impact assessment		
Environmental Theme	**Potential Impact**	**Score (--, -, 0, +, ++)**
decommissioning)	Displacement of sediments	0
Operation (including maintenance and repair)	Displacement of sediments	0
Navigation and safety		
Installation (and decommissioning)	Displacement of vessels	0
	Ship collisions	0
Operation (including maintenance and repair)	Risks associated with ships anchoring over the cable	0
Unexploded Ordnance		
Installation (and decommissioning)	Clearance of UXO and potential damage to surrounding receptors	0
Operation (including maintenance and repair)	Clearance of remobilised UXO and potential damage to surrounding receptors	0
Other sea users		
Installation (and decommissioning)	Reduced access to fishing ground	0
	Loss or damage to fish habitats	0
	Ship-ship collisions	0
	Direct damage to existing assets	0
	Restricted access to assets	0
Operation (including maintenance and repair)	Loss or damage to fishing gear as a result of cable protection measures	0

Overview results

5.4.4 Following the review of the assessment of impacts on the physical, biological and human environment the key conclusions that have been drawn are as follows:

- The main impacts associated with the Project are predicted to be minor temporary impacts to the benthic ecology and marine mammals during installation and decommissioning, which may result in a small negative effect.

- The submarine cable corridor passes through the Klaverbank SCI, which is designated for reefs in open sea (H1170) and are characterised by areas of harder ground and concentrations of boulders. The Viking Link seabed survey correlates with previous Klaverbank characterisation studies very well. The disturbance to the benthic environment will be minor and all areas of hard substrate have been avoided through route optimisation, reducing any direct interaction with potential areas of designated features. Increases in turbidity will be minor and only extend across a localised area around the submarine cable corridor, having a negligible effect on reef features. Therefore no negative effect is anticipated on the conservation objectives of the Klaverbank site.
- The installation of the two cables within the same trench and subsequent burial of the submarine cables, significantly limits the extent of disturbance from EMFs. As such, while there will be a minor, localised EMF emission no disturbance effects are anticipated on EMF sensitive species.
- The passage of current through the cable will generate heat but the effect will be limited in surface sediments. This heating effect would be much localised, only occurring in the sediment immediately surrounding the buried cables, and furthermore the seawater would remain at ambient temperature very close to the seabed surface. Heat emissions have been reduced by adequate depth of installation. Owing to depth of cover, heating from the cables is unlikely to affect infauna and it is therefore considered that disruption caused by heating from cables associated with the Project will not alter the reference situation for benthic ecology receptors.
- Any disturbance to navigation safety or other marine users will be short-term, localised and not significant. A risk based burial assessment has been carried out, with the depth of cover chosen based on an accepted minimal level of risk to avoid cable exposure and to reduce conflicts with navigation and fisheries.
- No significant negative impact is anticipated on archaeological features or through interaction with UXO. Mitigation measures will be put in place in case any features are identified along the submarine cable corridor during installation or during any maintenance activities.
- There are no other known projects within the Dutch EEZ or in the British or German EEZ that will interact with the Viking Link Project and as such no cumulative effect is anticipated.
- Decommissioning activities have been assessed as broadly similar to those during installation, and as such no strong negative effect is anticipated as a result of the Project.

Overview of knowledge gaps

5.4.5 The Dutch EIA Report has been based on up to date, relevant information supplemented with site specific surveys in order to provide a robust assessment. Consideration of any knowledge gaps and the potential effects on the assessment outcomes have been considered on a topic specific basis.

5.4.6 No knowledge gaps have been identified that have resulted in an uninformed assessment or that are anticipated to affect the assessment score. Pre-installation surveys will help inform the

reference situation further through the confirmation of any UXO and hitherto uncharted archaeological sites/objects along the submarine cable corridor.

Overview of mitigation measures

5.4.7 Mitigation measures have to be considered when a potential strong negative impact has been identified in order to avoid or reduce the level of impact to an acceptable level. When the assessment scores are not deemed significant, in EIA terms, mitigation measures are not required.

5.4.8 The following mitigation measures have been proposed in order to reduce the impacts of the Project:

- The residual impacts after consideration of mitigation measures are outlined in Table 6.
- With proper UXO Risk Management the risks can be reduced to a level that is as low as is reasonably practicable. UXO clearance surveys will be programmed before installation to identify any UXO along the submarine cable corridor. Any UXO that are identified within the submarine cable corridor and that cannot be avoided by micro routeing of the submarine cables will be removed by a specialist sub-contractor. A maintenance operations and monitoring plan will be prepared to provide for safe working protocols for operation and maintenance activities, including provisions for site safety instructions in the event that an item of UXO is located. Surveys will also be required before any cable removal operations which will identify potential UXO that may have to be relocated
- A buffer zone of 100m will be established around potential archaeological objects. Passive archaeological supervision will be conducted in order to prevent delays during installation works when unexpected archaeological remains are found. Any findings will be reported to the appropriate competent authority (Rijkswaterstaat Zee en Delta).
- The cable installation will be performed on a 24-hour basis to ensure minimal disruptions to navigation, commercial fishing and access to other assets. Notifications will be issued in accordance with statutory procedures to ensure navigational and operational safety (e.g. Notice to Mariners).
- Effective channels of communication will be established and maintained between the installation contractor and the other sea users. Project vessels will have passage planning procedures, holding positions, traffic monitoring, and emergency response plans.
- Crossing agreements with third party operators will be put in place, detailing the physical design of crossing, and outlining the rights and responsibilities of both parties, which will be in line with the *NEN3656 (requirements for steel pipes at sea).*

Table 6 Residual impacts after consideration of mitigation measures			
Environmental Theme	**Potential Impact**		**Score (--, -, 0, +, ++)**
Marine Mammals			
Construction and decommissioning	Temporary underwater noise	Installation activities	0
		Geo-physical surveys - Disturbance	-
		Geo-physical surveys - Injury	0
		UXO clearance - Injury	-
	Temporary collision risk		0
	Temporary indirect effects to prey resources		0
	Temporary hydrocarbon or chemical spills		0
	Temporary disturbance to contaminated sediment		0

5.5 Summary of Environmental Effects – German Sector

Potential Impacts during installation

Seabed Disturbance

5.5.1 The installation of submarine power cables has the potential to cause physical disturbance of seabed shallow substrata, potentially resulting in sediment redistribution and increased turbidity which could lead to alterations to the local habitat and shifts in benthic faunal community structure.

5.5.2 The seabed disturbance is restricted to a narrow strip of seabed up to 15 m wide depending on the installation method used. Impacts on the sediments such as mechanical stress caused by sediment displacement, compaction or vibrations during installation are rated as low-impact due to their small scale. For sandeels, a fish species spending extensive times of their life cycle buried in the sediment, a localised temporary loss of habitat may result from the sediment disturbance. However, no sandeel habitats have been documented in the area under consideration. The overall impact on sand eel distribution in the long-term is expected to be minimal.

Increased suspended sediment concentrations and deposition

5.5.3 In the area of the submarine cable corridor across the German survey area the sediments are dominated by sand. The organic content is relatively low and correlated with the finer sand

fraction. Consequently the majority of suspended sediments will be re-deposited in the immediate vicinity of the cable corridor. The potential impact on sediment and water quality is expected to be negligible. The main risk for benthic organisms is the sedimentation of suspended sediment and the smothering of sessile species by burial. Smothering may occur within the immediate vicinity of cables. The impact is however only expected to be temporary in nature and localised in extent. The majority of North Sea fish species are pelagic spawners and as such considered to be of low vulnerability and high resilience with regard to increased suspended sediments. The magnitude of the effect is considered to be low, resulting in a minor adverse impact.

Potential contaminant release from sediment

5.5.4 Nutrients and organic pollutants as well as metals may be released from the sediments to the water column as a short-term effect of the cable installation. Although physiological effects arising from the remobilisation of contaminants can be harmful to benthic invertebrates, fish species and marine mammals, the pollution in the EEZ is comparatively low. The potential effect is predicted to be local in extent and temporary in nature.

Underwater Noise

5.5.5 Underwater noise will be produced by vessels and machinery used during cable installation. Maximum sound pressure levels from cable installation or operation are generally considered to be low and the noise is continuous in nature during installation operations which is relatively short term. Although behavioural reactions of individual fishes may arise, the effect is predicted to be localised, transient and temporary. Also due to the high background noise levels across the North Sea, no long-term effect on individual fish and no effect on population level are predicted. Also disturbance to marine mammals from the installation activities for the Project will be localised, transient and temporary; therefore impacts are expected to be minimal. No significant impacts on marine birds are anticipated to arise from the vessel noise.

Marine Archaeology

5.5.6 During the pre-assessment no Marine Archaeology have been found within the cable corridor. Therefore, no impacts on Marine Archaeology are expected.

Installation - Conclusions

5.5.7 It is assessed that the installation will cause no significant negative impacts on any habitat, community or biotopes across the German territory.

Potential Impacts during operation

5.5.8 The potential impacts during operation of the power cables include the emission of heat and EMF.

Heating Effects

5.5.9 During operation, waste heat from the cables must not increase temperature levels of the sea bed by more than 2 Kelvin in 20 cm depth in order to avoid adverse environmental impacts (the so called “2 K criterion”), therefore no significant impact on water quality, seabed chemistry, benthic invertebrates or fishes are expected.

Electromagnetic Radiation

5.5.10 During operation, the planned high voltage DC electrical interconnector with an approximate capacity of 1,400 MW contributes to the emission of electromagnetic radiation. The magnetic field for the cables is strongest directly over the cable and decreases rapidly with small incremental distance. Although the factor is permanent in duration, a minor impact on sediment chemistry and benthic invertebrates is expected. Low impacts are also assumed for fish species without specially developed electroreception. No significant effect is anticipated on migratory or orientation behaviour of marine mammals. Overall it is concluded that significant population level effects due to repulsion are unlikely within the German sector as the cable is bundled and the effects are very local.

Other Sea Users

5.5.11 Impacts due to the cable itself which might cause damage to fishing equipment (nets, hooks, anchors) are not possible, as the cable is buried 1.5 m below the seabed and is not expected to become exposed through sediment movements. Anchoring is not allowed within areas of cables and pipelines. The area of crossing requires a pre-defined structure to ensure the protection of the pipelines.

5.5.12 The impact on the pipelines is short-term for the installation phase but permanent for the crossing structure. The extent during operation is only small-scale and the intensity small.

In-Combination /Transboundary Effects

5.5.13 The contribution of subsea cable effects to cumulative or in-combination effects caused by installation, maintenance or decommissioning activities is generally considered to be limited because of the short-term nature of burial/recovery activities.

5.5.14 No significant transboundary effects are anticipated by the installation, operation and decommissioning of the submarine cables.

Protected Sites

5.5.15 Due to large distances between the proposed submarine cable corridor and the Natura 2000 areas, taken together with the identified zones of influence, impacts of the installation or operation of the submarine cables on Habitats Directive habitat types can be safely excluded.

5.5.16 The specific species protection assessment concludes that installation and operation of the proposed submarine cable would not violate prohibitions regarding the conservation of strictly protected species according to Article 44(1) Federal Nature Conservation Act.

5.5.17 Based on the results of the special biotope protection assessment any presence of the biotope types legally protected according to Article 30 of the Federal Nature Conservation Act in the German section of submarine cable corridor can be safely ruled out.

Operation - Conclusions

5.5.18 It is assessed that no operation-related impacts will cause significant negative impacts on any habitat, community or biotopes across the German territory.

5.6 Summary of Environmental Effects – Danish Sector

Installation Phase

5.6.1 The construction activities will cause physical modifications of the seabed due to pre installation route clearing and excavation of the cable trenches. The amounts of sediment suspended in the water column will increase and lead to increased sedimentation of material on the seabed. The general activities from Project vessel traffic during the construction phase will intensify and may cause enhanced noise levels and enhanced risk of collisions. These factors may affect the marine flora and fauna near the submarine cable corridor.

Suspended Sediments

5.6.2 The seabed along the submarine cable corridor is dominated by sandy sediments with coarse material such as sand and gravelly sand, which have high deposition rates. Therefore, the majority of the suspended material is expected to settle within a short distance from the cable route. The North Sea is a dynamic water body with strong currents which cause high natural concentrations of suspended sediment in the water column. The marine flora and fauna in the North Sea is thus adapted to the dynamic sediment conditions. Overall, the impacts from the physical modifications, suspended sediment and sedimentation during construction are assessed to be insignificant regarding marine habitats and benthic flora and fauna.

Fish

5.6.3 The fish that are present near the submarine cable corridor during installation may potentially be affected by suspended sediment, modified water quality and increased vessel traffic. The

duration of the sediment suspension and increased vessel traffic will, however, will be short and fish near the submarine cable corridor are expected to swim to adjacent areas and return to the area after the construction activities have been completed. Furthermore, the fish in the North Sea are adapted to the natural high dynamics of suspended sediment. Overall, the potential impacts on fish from suspended sediment and increased vessel traffic are assessed to be negligible and thus insignificant.

Marine Mammals

5.6.4 Marine mammals may potentially be affected during the cable installation phase due to increased vessel traffic and modifications of the seabed during construction. The disturbance may cause displacement and reduce the food availability. The duration of the impacts will however be short-term and it is expected that marine mammals will return to the area shortly after the disturbance. Overall, based on the assessments no significant impacts on marine mammals are expected during cable installation.

Marine Birds

5.6.5 Marine birds may potentially be affected by increased Project vessel traffic during the cable installation phase of the submarine cable and changes in the food availability. The disturbance may cause temporary displacement of fish and birds and there-by prevent their exploitation of the area. Overall, no significant effects are assessed on fish and marine birds during cable installation.

Commercial Fisheries

5.6.6 The construction activities may affect the commercial fisheries in a short period, but overall it is assessed, that the potential impacts on commercial fishery will be insignificant.

Marine Archaeology

5.6.7 The construction installation and activities related to maintenance and decommissioning may potentially affect archaeological objects. It is assessed that there will be no significant impacts on known manmade archaeological objects as restriction zones with a radius of minimum 50m will surround the objects. Potential stone-age settlements will not be impacted as they are placed below the cable burial depth. The construction activities must be stopped if archaeological objects or sites are found and any find must be reported to the Danish Agency for Culture.

Shipping and Navigation

5.6.8 Shipping and navigation may be affected during the construction phase of the submarine cables, since the presence of Project vessels and the increased activity in the area around the submarine

cable corridor may increase the risk of ship collisions or groundings. Overall, the potential impacts on shipping and navigation during construction are assessed to be insignificant.

Operations Phase

Electromagnetic Fields

5.6.9 During the operation phase, presence of EMF and heat near the submarine cables, may potentially affect fish and benthic fauna. The EMF will be lower than the naturally occurring field at a distance of more than 10 m from the cable for bundled cables, while this will be 50 m for un-bundled cables (National Grid and Energinet.dk, 2016). The potential heat in-crease in the cable corridor will be well below the natural seasonal temperature changes in the North Sea area. Overall, it is assessed that fish and benthic fauna will not be affected by EMF or heat from the submarine cables.

Heating Effects

5.6.10 The operation of the submarine cables can cause heat emission, which could potentially impact the benthic fauna. The potential temperature increase in the cable corridor will be limited that the impacts of the benthic fauna in the cable corridor due to heat emission will be insignificant.

Fisheries

5.6.11 When the submarine cables are installed, a safety zone of 200m to each side of the cables will be in place. Within this zone, no bottom trawling must be under-taken. The fishing restrictions will be permanent throughout the Project's life-time, and may result in reduced catches. In general, the bottom trawl fishing may be impeded as the restrictions hinder bottom trawling to be undertaken across the cables.

5.6.12 The impact on fishing with other gear than bottom trawling, is assessed to be insignificant, as these activities will be allowed within the cable corridor after installation. Overall, it is assessed that the impact on the commercial fisheries in the operation phase will be minor.

Cumulative Impacts

5.6.13 The analysis of potential cumulative impacts showed that potential cumulative impacts from relevant projects would be insignificant.

Conclusions

5.6.14 Overall, the assessment of potential impacts on individual environmental aspects showed that no significant impacts are expected to occur from construction, operation and decommissioning of the Viking Link submarine cables. Also, no potential cumulative impacts are assessed as being significant. It is assessed, that the Project will not influence the ecological or chemical status of

the area and thereby the implementation of the Water Frame Directive. Likewise, the Project will not prevent the aim of good ecological status before 2020 as stated in the Marine Strategy in the North Sea area. Furthermore, there are no potential for likely significant impacts to occur on the protected habitats and species in the Natura 2000 area Sydlige Nordsø. Finally, the Project will not disturb the relevant Annex IV species, harbour porpoise, in its natural habitat, and the Project will not harm or destroy the natural breeding and roosting areas of the harbour porpoise.

5.6.15 Since no significant impacts are expected from the Project, no mitigation measures should be implemented in the Danish EEZ.

6 Conclusions

6.1.1 Viking Link is in line with the European Commission's aim for an integrated energy market to ensure value for money for consumers and provides the opportunity to transport renewable energy to centres of consumption.

6.1.2 The interconnector has an approximate capacity of 1400 megawatt (MW), and crosses through the EEZ of UK, the Netherlands, Germany and Denmark.

6.1.3 The intention of this Bridging Document is not to convey all of the information relating to Viking Link and its potential effects on the environment. This document provides a summary of the findings of the detailed environmental assessments which accompany the permit applications in each jurisdiction. More detailed information on the Project and the environmental assessments is contained within the permit applications and supporting documentation.

6.1.4 The EIA of the UK Onshore Scheme has identified and assessed the likely significant effects which would result from its construction and operation. Through careful siting and routeing as well as embedding mitigation within the base scheme design, NGVL, has prevented or reduced a number of potentially significant environmental effects. However, given the scale of the UK Onshore Scheme some significant environmental effects are unavoidable and as such some will remain following mitigation. As set out within the UK Onshore EIA, the majority of significant environmental effects will occur during construction of the UK Onshore Scheme and whilst significant they will be temporary lasting for the duration of construction works only. Where significant environmental effects are predicted to be permanent these relate to above ground components of the UK Onshore Scheme only (the proposed converter station and the permanent access road).

6.1.5 For UK offshore, the ES presents a comprehensive assessment of the potential impacts of the installation, operation (including maintenance and repair) and decommissioning of the Project, and sets out proposed Best Practice and Project specific mitigation measures to avoid or reduce the impact to an acceptable level. The Best Practice and mitigation measures will form the basis of an Environmental Management Plan to be implemented during the installation and operation of the submarine cables.

6.1.6 In the Dutch Sector, the EIA Report is the result of a comprehensive EIA based on thorough consultation. The Report has concluded that the proposed submarine cables will not result in a strong negative impact or a significant impact in EIA terms. In many cases this is due to the sensitive siting of the Project to avoid adverse impacts all together. The assessment has been undertaken with the best available knowledge and no knowledge gaps are anticipated to effect the conclusions. Where potentially significant negative impacts have been identified mitigation measures have been proposed to reduce the impact.

6.1.7 In the German Sector, it is assessed that the installation will cause no significant negative impacts on any habitat, community or biotopes across the German territory. During operation, it is

assessed that no operation-related impacts will cause significant negative impacts on any habitat, community or biotopes across the German territory.

6.1.8 In the Danish Sector an environmental assessment has been carried out for the submarine cables in the Danish waters. Environmental Report concludes that the installation of the submarine cables will not cause any significant negative impacts on any habitat, community or biotopes across the Danish territory. During operation, it is assessed that no operation-related impacts will cause significant negative impacts on any habitat, community or biotopes across the Danish territory.

6.1.9 The Danish onshore elements is subject to an EIA and planning proposal have to be developed. The EIA has identified and assessed the likely significant effects from the the construction and operation phases. Mitigation measues have been embedded in the installation methods to reduce the potential significant environmental impacts. However, given the scale of the converter station some significant environmental effects are unavoidable.

7 References

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