Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects

Offshore Design Statement

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Contents

Glossary of Acronyms

AfL	Agreement for Lease Area Definition
AIS	Automatic Identification System
AOI	Area of Interest
AONB	Area of Outstanding Natural Beauty
CSCB	Cromer Shoal Chalk Beds
DCO	Development Consent Order
DEFRA	Department for the Environment and Rural Affairs
DOW	Dudgeon Offshore Windfarm
EIA	Environmental Impact Assessment
ES	Environmental Statement
GHG	Greenhouse Gas
HDD	Horizontal Directional Drilling
HVAC	High-Voltage Alternating Current
HVDC	High-Voltage Direct Current
km	Kilometre
kV	Kilovolt
LPA	Local Planning Authority
MCA	Maritime and Coastguard Agency
MCZ	Marine Conservation Zone
MGN	Marine Guidance Note
MW	Megawatts

NIC	National Infrastructure Commission
NMP	Navigational Management Plan
NNDC	North Norfolk District Council
NNR	National Nature Reserves
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
OS	Ordnance Survey
OSP	Offshore Substation Platform/s
OWF	Offshore Wind Farm
SAC	Special Area of Conservation
SEP	Sheringham Offshore Wind Farm Extension Project
SNC	South Norfolk Council
SNS	Southern North Sea
SOW	Sheringham Offshore Windfarm
SSSI	Site of Sepcial Scientific Interest
TCE	The Crown Estate
TEU	Treaty of the European Union
TH	Trinity House
WTG	Wind Turbine Generator
WWI	World War I
WWII	World War II
ZVI	Zone of Visual Influence

Glossary of Terms

Dudgeon Offshore Wind Farm Extension site	The Dudgeon Offshore Wind Farm Extension offshore lease area.
Dudgeon Offshore Wind Farm Extension Project (DEP)	The Dudgeon Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
DCO boundary	The area subject to the application for development consent, including all permanent and temporary works for DEP and SEP.
European site	Sites designated for nature conservation under the Habitats Directive and Birds Directive. This includes candidate Special Areas of Conservation, Sites of Community Importance, Special Areas of Conservation and Special Protection Areas, and is defined in regulation 8 of the Conservation of Habitats and Species Regulations 2017.
Horizontal directional drilling (HDD) zones	The areas within the onshore cable route which would house HDD entry or exit points.
Infield cables	Cables which link the wind turbine generators to the offshore substation platform(s).
Interlink cables	Cables linking two separate project areas. This can be cables linking: 1. 10 DEP South and DEP North 2. DEP South and SEP 3. DEP North and SEP 1 is relevant if DEP is constructed alone or first in a phased development. 2 and 3 are relevant in an integrated construction.
Integrated Grid Option	Transmission infrastructure which serves both extension projects.
Landfall	The point at the coastline at which the offshore export cables are brought onshore and connected to the onshore export cables.
Offshore export cables	The cables which would bring electricity from the offshore substation platform(s) to the landfall. 220 – 230kV.
Offshore substation platform	A fixed structure located within the wind farm area, containing electrical equipment to aggregate the power from the wind turbine generators and convert it into a more suitable form for export to shore.
Onshore cable corridor	The area between the landfall and the onshore substation sites, within which the onshore cable circuits will be installed along with other temporary works for construction.
Onshore export cables	The cables which would bring electricity from the landfall to the onshore substation. 220 – 230kV.
Onshore Substation	Compound containing electrical equipment to enable connection to the National Grid.
Separated Grid Option	Transmission infrastructure which allows each project to transmit electricity entirely separately.
Study area	Area where potential impacts from the project could occur, as defined for each individual EIA topic.
Sheringham Shoal Offshore Wind Farm Extension site	Sheringham Shoal Offshore Wind Farm Extension lease area.
Sheringham Shoal Offshore Wind Farm Extension Project (SEP)	The Sheringham Shoal Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
The Applicant	Equinor New Energy Limited. As the owners of SEP and DEP, Scira Extension Limited (SEL) and Dudgeon Extension Limited (DEL) are the named undertakers that have the benefit of the Development Consent Order. References in this document to obligations on, or commitments by, 'the Applicant' are given on behalf of SEL and DEL as the undertakers of SEP and DEP.
Transition joint bay	Connects offshore and onshore export cables at the landfall. The transition joint bay will be located above mean high water.

1.0 Introduction

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1.1.1 This Offshore Design Statement has been prepared on behalf of the Applicant, 'Equinor New Energy Limited' ('Equinor') in support of the application for a Development Consent Order (DCO) for the proposed Sheringham Shoal Offshore Wind Farm Extension Project (SEP) and Dudgeon Offshore Wind Farm Extension Project (DEP).

1.1 Purpose of Document

1.1.1 This Offshore Design Statement for SEP and DEP is prepared pursuant to Regulation 5(2)(q) of The Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009 and forms part of a suite of supporting documents for the DCO application.

1.1.2 The purpose of this Offshore Design Statement is to demonstrate how SEP and DEP will fulfil the requirement for good design as set out within the draft Overarching National Policy Statement for Energy (NPS EN-1) (2021). It explains the design evolution of the offshore works to date and the considerations that will inform the detailed design of the final offshore works in a clear and structured way. This statement addresses the operational phase of SEP and DEP. It does not cover the onshore environment or the construction stages of the project, which are described in the **ES Chapter 4 Project Description** (document reference 6.1.4) and the **Onshore Design and Access Statement** (document reference 9.3).

1.1.3 This document also highlights the important role played by consultation and the way in which it has influenced the indicative layout and design of the proposed offshore works, including particularly Natural England, the MCA, the Norfolk Coast Partnership and the relevant local authorities.

FIGURE 1.1 : Location plan

1.2 Document Structure

1.2.1 This report has been subdivided into the following sections:

- **Design Framework:** establishes how the project will fulfil the criteria of 'good design' through a clearly defined vision and objectives.
- **Site Context:** an overview of the physical, environmental, social and cultural context of the offshore works.
- **Delivering Good Design:** establishes the approach to good design.
- **Agreement for Lease Area Definition:** summary and justification of the Agreement for Lease (AfL) area definition.
- **Layout:** summary and justification of the turbine layout design proposals.
- **Wind Turbine Generators:** summary and justification of the turbine generator design proposals.
- **Electrical Infrastructure:** summary and justification of the electrical infrastructure including the offshore export cables, interlink cables and infield (array) cables.
- **Conclusion:** summary of the SEP and DEP offshore works design proposals.

1.3 Project Overview

1.3.1 A description of the key components of the proposed SEP and DEP, as well as details of how the wind farms will be constructed, operated, maintained and decommissioned is provided in **ES Chapter 4 Project Description** (document reference 6.1.4).

1.3.2 SEP and DEP will each have a maximum export capacity greater than 100 megawatts (MW). The SEP and DEP wind farm sites are 15.8 kilometres (km) and 26.5km from the coast for SEP and DEP respectively at their closest point (**Figures 1.1** and **1.2**).

1.3.3 SEP and DEP will be connected to shore by offshore export cables installed to the landfall at Weybourne, on the north Norfolk coast. From there, the onshore export cables travel approximately 60km inland to a new high voltage alternating current (HVAC) onshore substation near to the existing Norwich Main substation. The onshore substation will be constructed to accommodate the connection of both SEP and DEP to the transmission grid.

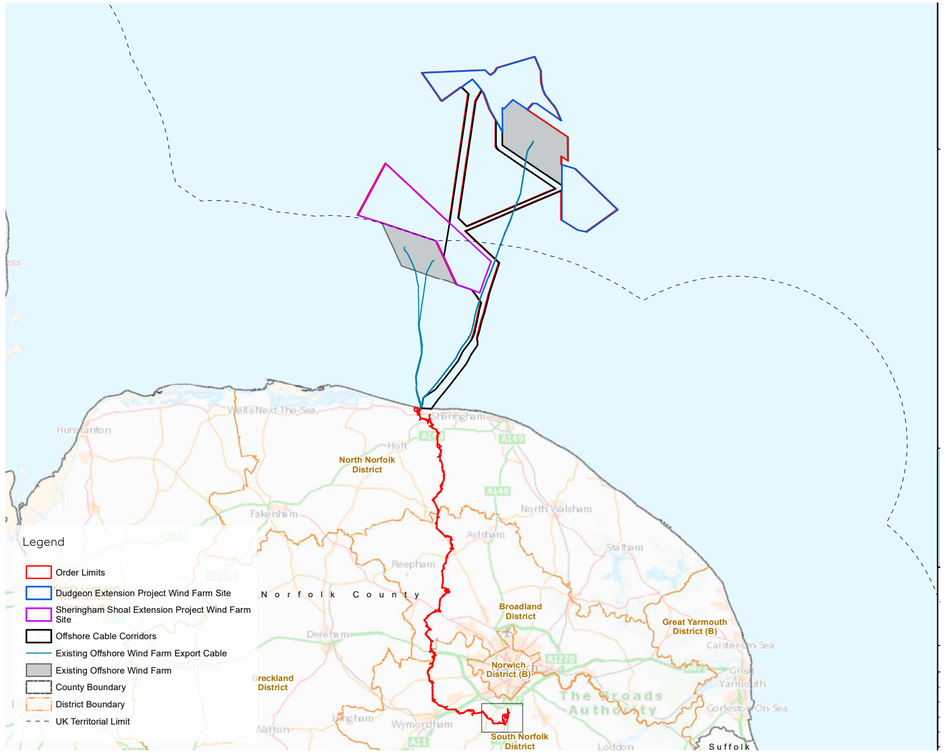


FIGURE 1.2 : Overview of the project

1.3.4 The key offshore components comprise:

1.3.5 Wind turbines;

- Offshore substation platform/s (OSP);
- Foundation structures for wind turbines and OSP/s;
- Infield cables;
- Interlink cables; and
- Export cables from the wind farm sites to the landfall.

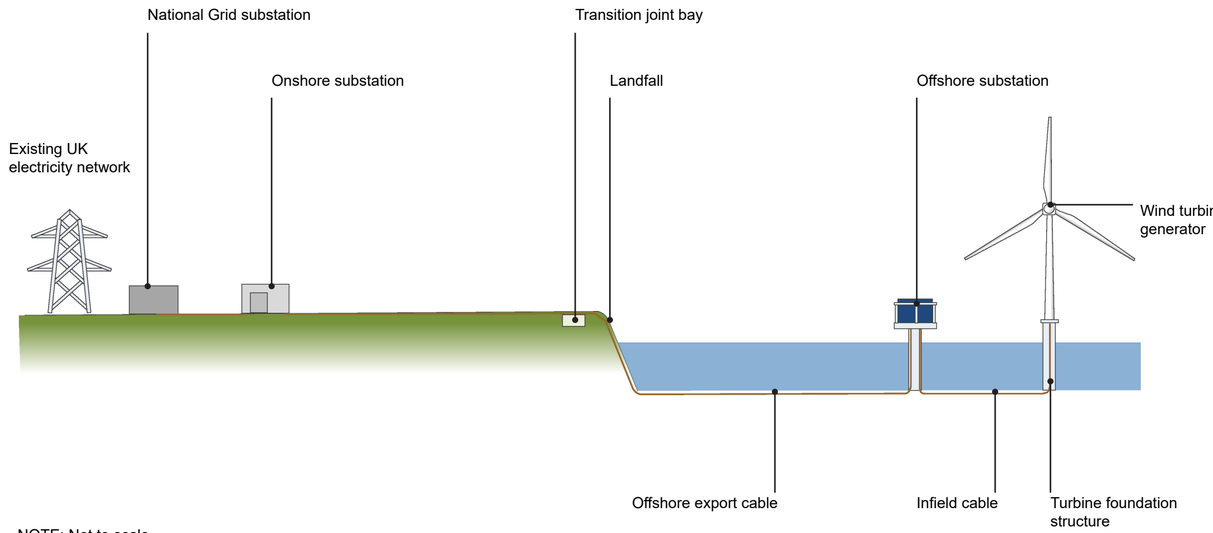
1.3.6 The key onshore components comprise:

- Landfall and associated transition joint bay/s;
- Onshore export cables installed underground from the landfall to the onshore substation and associated joint bays and link boxes;
- Onshore substation/s and onward 400 kilovolt (kV) connection to the existing Norwich Main substation;
- Trenchless crossing zones (e.g. Horizontal Directional Drilling (HDD));
- Construction and operational accesses; and
- Temporary construction compounds.

1.3.7 An overview schematic of the key offshore and onshore project infrastructure is shown in **Figure 1.3**.

1.3.8 The offshore works are the primary focus of this document and are described in detail in the subsequent chapters.

FIGURE 1.3 : Overview schematic of the key offshore and onshore project infrastructure



NOTE: Not to scale

1.4 Project Development Scenarios

1.4.1 As set out in the **ES Chapter 4 Project Description** (document reference 6.1.4),), whilst SEP and DEP have different commercial ownerships and are each Nationally Significant Infrastructure Projects (NSIPs) in their own right, a single application for development consent is being made for both wind farms, and the associated transmission infrastructure for each. A single planning process and DCO application is intended to provide for consistency in the approach to the assessment, consultation and examination, as well as increased transparency for a potential compulsory acquisition process.

1.4.2 The Applicant is seeking to coordinate the development of SEP and DEP as far as possible. The preferred option is a development scenario with an integrated transmission system, providing transmission infrastructure which serves both of the wind farms, where both projects are built concurrently. However, given the different commercial ownerships of each Project, alternative development scenarios such as a separated grid option (i.e. transmission infrastructure which allows each Project to transmit electricity entirely separately) will allow SEP and DEP to be constructed in a phased approach, if necessary. Therefore, the DCO application seeks to consent a range of development scenarios in the same overall corridors to allow for separate development if required, and to accommodate either sequential or concurrent build of the two projects.

1.4.3 Reasons for the requirement to retain separate and phased (sequential) development scenarios alongside more coordinated approaches are further described in the **Scenarios Statement** (document reference 9.28).

1.4.4 The range of development scenarios considered for SEP and DEP can be broadly categorised as:

- In isolation – where only SEP or DEP is constructed;
- Sequential – where SEP and DEP are both constructed in a phased approach with either SEP or DEP being constructed first; or
- Concurrent – where SEP and DEP are both constructed at the same time.

1.4.5 Whilst SEP and DEP are the subject of a single DCO application (with a combined Environmental Impact Assessment (EIA) process and associated submissions), the assessment considers both projects being developed in isolation, sequentially and concurrently.

1.4.6 In the concurrent development scenario, there will need to be collaboration between the two projects to optimise construction logistics and to share certain temporary works such as the haul road and construction compounds. This applies to a concurrent build regardless of whether the transmission systems are integrated. The extent of coordination will be determined post consent.

1.4.7 Each of the development scenarios offer a range of benefits, with the preferred option particularly benefitting the planning and construction of the projects, being likely to reduce the overall environmental impact and disruption to local communities, and responding to concerns regarding the lack of a holistic approach to offshore wind development in general. For example, the preferred option would only require one haul road for construction activities, and half the number of work fronts.

2.0 Design Framework

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2.1 Project Vision

2.1.1 The **Project Vision** (document reference 9.27) sets out the vision and objectives for SEP and DEP.

The Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Project will double the generation capacity of the existing assets by 2030, making a meaningful contribution to the UK's offshore wind and decarbonisation targets.

As a result of our long-term presence in Norfolk, Equinor has identified the need to take a coordinated approach to the development of the two projects, to minimise impacts on local communities and to maximise benefits for the area. As a result of this coordinated planning, the Project has proposed utilising a shared transmission asset through Norfolk, and has been selected as a Pathfinder project in coordinated offshore transmission development under the UK Government's Offshore Transmission Network Review. The design of the shared transmission asset will enhance the environment and create lasting value for local people and communities in Norfolk.

2.2 Design Objectives

2.2.1 Overarching Energy National Policy Statement EN-1 establishes the criteria for good design for energy infrastructure in its statement that (paragraph 4.5.1) "Applying 'good design' to energy projects should produce sustainable infrastructure sensitive to place, efficient in the use of natural resources and energy used in their construction and operation, matched by an appearance that demonstrates good aesthetic as far as possible" and that (paragraph 4.5.2) "Good design is also a means by which many policy objectives in the NPS can be met, for example the impact sections show how good design, in terms of siting and use of appropriate technologies can help mitigate adverse impacts such as noise". The Statement requires the SoS (paragraph 4.5.3) "to be satisfied that energy infrastructure developments are sustainable and, having regard to regulatory and other constraints, are as attractive, durable and adaptable (including taking account of natural hazards such as flooding) as they can be. In so doing, the [SoS] should satisfy itself that the applicant has taken into account both functionality (including fitness for purpose and sustainability) and aesthetics (including its contribution to the quality of the area in which it would be located) as far as possible".

FIGURE 2.1 : Design objectives

2.2.2 The National Infrastructure Commission (NIC) provide expert impartial advice to Government on major infrastructure projects. The NIC's Design Group has identified four principles to guide the planning and delivery of major infrastructure projects: Climate, People, Places and Value. These four principles have been used to develop design objectives for SEP and DEP. A fifth objective, Safety, has also been added to reflects Equinor's commitment to providing a safe and secure environment for everyone working at our facilities and job sites, as illustrated by **Figure 2.1**.

2.2.3 These objectives will ensure the project fits sensitively into the local context, mitigating and providing enhancements to community and environment where possible whilst achieving the requirements of energy production to help meet growing demand for low carbon energy.

2.2.4 The following design objectives have been identified:

DESIGN OBJECTIVES	
SAFETY	
1	Always be safe and committed to preventing harm to people, to the environment and the communities we are a part of and comply with regulatory requirements in the construction, operation and decommissioning of the projects
CLIMATE	
2	Maximise generation capacity within constraints to positively contribute to the UK energy transition and net-zero target by 2050
3	Prioritise sustainable resource management and techniques and minimise carbon emissions throughout the project lifecycle
4	Design for resilience and adaptation to future climate change
PEOPLE	
5	Behave as a considerate neighbour through both construction and operation
6	Engage openly, transparently and meaningfully with stakeholders taking their feedback into account and making use of local knowledge to improve our projects
7	Be proactive and collaborative about developing local skills, jobs and employment opportunities throughout construction and operation of the wind farms

DESIGN OBJECTIVES	
VALUE	
8	Recognising the advancing nature of technology, coordinate project elements and their construction aim to serve multiple needs to maximise efficiency
9	Foster innovation and extend supply chain to leave a lasting legacy value for Norfolk and the UK
PLACE	
10	Protect the amenity of our neighbours and local communities and where possible enhance the environment and green infrastructure including protecting biodiversity and developing measures aiming to deliver Biodiversity Net Gain
11	Respond to the distinctive and unique character of the local landscape / seascape, including the Norfolk Coast AONB and views out to sea
12	Recognise and respect the history and settings of local historic and cultural assets

TABLE 2.1 : Design objectives

2.2.5 The project objectives and design objectives have set the framework for the development of SEP and DEP, and under which the projects will continue to evolve through detailed design work into construction and operation. More specific layout commitments and design principles have been considered for SEP and DEP, and these will guide the design of the onshore and offshore infrastructure for the projects.

3.0 Site Context

3.0 Site Context

3.1 Site Overview

3.1.1 The SEP and DEP wind farm sites are located in the Greater Wash region of the Southern North Sea (SNS), with the closest point to the coast being 15.8km from the SEP wind farm site and 26.5km from the DEP wind farm site (**Figure 3.1**). offshore Order Limits include the SEP and DEP wind farm sites as defined by The Crown Estate (TCE) AfL areas and the offshore cable corridors required to connect the wind farm sites together (interlink cable corridors) or connect the wind farm sites to the landfall (export cable corridors).

3.2 Bathymetry and Geology

3.2.1 Water depths at the SEP and DEP wind farm sites range from 14m below Lowest Astronomical Tide (LAT) in the northwest of the SEP wind farm site to 36m in the northwest of the DEP North array area. The sea bed gradient across both wind farm sites is generally relatively flat (i.e. less than 1°).

3.2.2 Water depths along the interlink cable corridors are between 10m and 35m. Again, the sea bed is generally relatively flat. Water depths along the offshore export cable corridor are between 25m and 27m in the area closest to the SEP wind farm site, decreasing progressively to 0m at the coast.

3.2.3 The geology of SEP and DEP generally consists of Holocene deposits overlying a series of Pleistocene sands and clays, with a bedrock of Upper Cretaceous Chalk. The chalk is only exposed (outcropping) at the sea bed within the landward 500m of the offshore export cable corridor. The predominant surface sediment types across the offshore sites are medium and coarse sands and gravels, and outcropping chalk in the landward 500m of the offshore export cable corridor. The dynamic nature of the coast means that large quantities of sediment are constantly moved around the site by tides and currents thus sediment distribution and rock exposures are subject to change.

3.2.4 Up to 11km of the offshore export cable corridor passes through the Cromer Shoal Chalk Beds (CSCB) Marine Conservation Zone (MCZ). The MCZ protects important geological features including the best examples of subtidal chalk beds in the North Sea, as well as subtidal exposures of clay and peat.

3.2.5 Further detailed analysis of the existing environment is provided in **Chapter 6: Marine Geology, Oceanography and Physical Processes** (document reference 6.1.6).

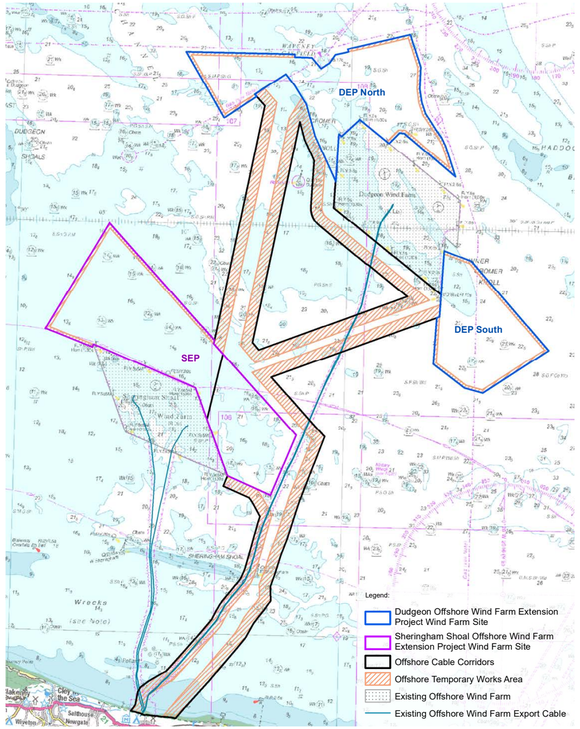

FIGURE 3.1 : Extent of proposed offshore works

3.3 Seascape and Landscape

3.3.1 The SEP and DEP wind farm sites are located within an area of the North Sea that is characterised, in general, by a "wild and dynamic" seascape that is heavily influenced by the tides and the variation in the seabed. Its visual environment is strongly influenced by its relationship with the land, which predominantly comprises a flat and low-lying linear coastline that offers long sweeping views along it and out to sea. The perception of land and sea is clearly marked by the gently rolling dune system and vast intertidal sand flats (at low tide), which all contribute to a sense of 'remoteness' in its character.

3.3.2 The remote nature of the seascape and coastline is influenced (in places) by the presence of settlements; major shipping routes; offshore gas extraction and aggregate extraction activities; coastal holiday resorts; commercial offshore activities (such as fishing, dredging and dumping); and on- and offshore wind farm developments.

3.3.3 The 'East Inshore Marine Plan Area and East Offshore Marine Plan Area' describes the key characteristics of its identified Seascape Character Areas (SCA). Each SCA within SEP's and DEP's study area are shown in **Figure 3.2** and listed below for reference:

- East Midlands Offshore Gas Fields (SCA 3) – A small part of the SEP wind farm site and the majority of the DEP wind farm site lies within SCA3.
- East Midlands Coastal Waters (SCA 7) – Only the SEP wind farm site lies within SCA7.
- Norfolk Coastal Waters (SCA 9) - Parts of both the SEP and DEP wind farm sites lie within the edge of SCA9.

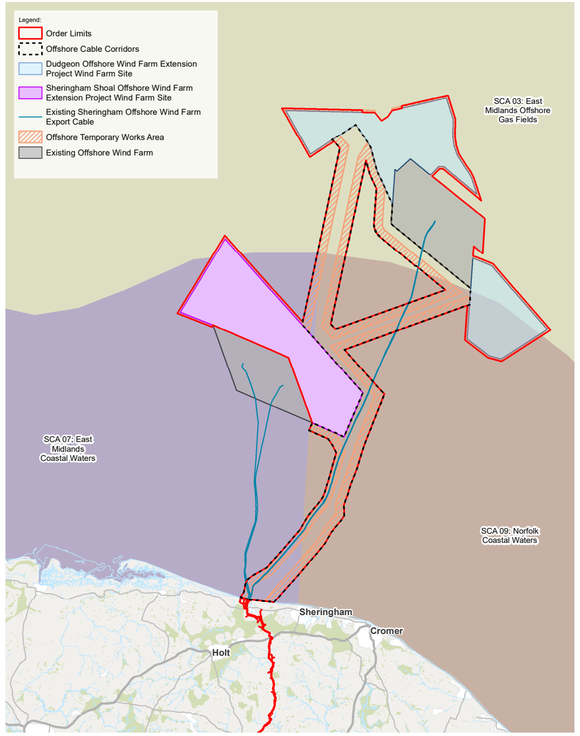

FIGURE 3.2 : Seascape

3.3.4 Existing views across and out to the North Sea include several offshore wind farm developments with the extent of visibility dependant on the prevailing atmospheric conditions and distance. From onshore locations, SEP and DEP would be visible alongside the existing wind arrays from various locations along the shoreline and generally 1 - 5km inland between Old Hunstanton and Cromer; and a narrow strip of coastline between Cromer and Winterton-on-Sea. Further inland, potential visibility would decrease with distance. **Figure 3.5** illustrates some typical views of the site.

3.3.5 **Figure 3.3** shows the location of the Norfolk Coast Area of Outstanding Natural Beauty (AONB) and the location of the North Norfolk Heritage Coast (NNHC). The Norfolk Coast AONB is a nationally designated landscape with the primary purposes to conserve and enhance the natural beauty of the landscape. This designated landscape will not be directly impacted by the proposed offshore arrays, although views from the Norfolk Coast AONB would be possible from onshore locations between 1 - 5km inland from the shoreline. Should longer range views be possible, SEP and DEP would be seen alongside other existing wind farm developments and/or would be barely perceptible.

3.3.6 The NNHC is a non-statutory landscape definition, although it is widely recognised that this section of coastline is one of the finest stretches of undeveloped coast in England and Wales.

3.3.7 Further detailed analysis of the existing environment is provided in **Chapter 25 Seascape and Visual Impact Assessment** (document reference 6.1.25).

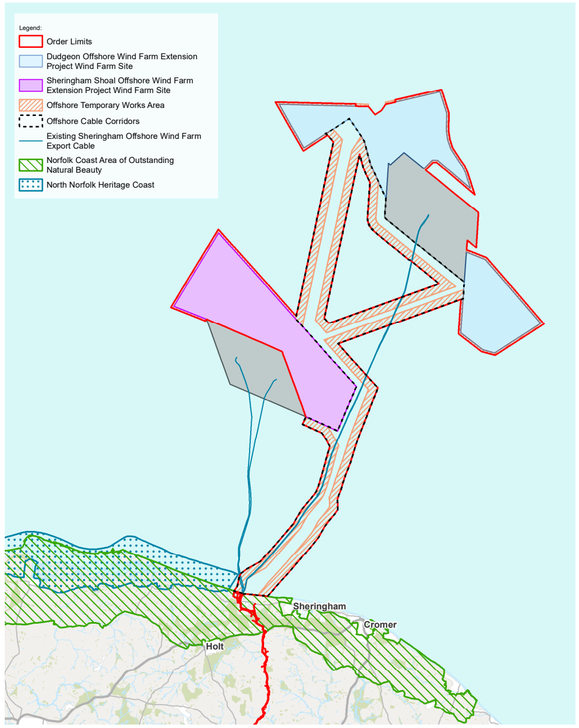

FIGURE 3.3 : Landscape

3.4 Marine Ecology and Ornithology

3.4.1 The benthic and demersal fish communities are typical of the seabed sediments in this part of the North Sea, and include attached and mobile epifauna.

3.4.2 Within the SNS area, harbour porpoise are the most common marine mammal species. Other key marine mammal species present in the area include bottlenose and white-beaked dolphin, minke whale and grey and harbour seal.

3.4.3 Over 30 ornithology species were recorded in the SEP and DEP aerial survey, ranging from migratory waders and waterbird species on passage to resident gull species. There is connectivity between SEP and DEP, and important populations of breeding seabirds (e.g. Sandwich tern breeding on the North Norfolk Coast, and kittiwake breeding at the Flamborough and Filey Coast). However, neither SEP, DEP or surrounding waters are of particularly high importance for foraging, commuting to foraging areas, or other activities for any species. Outside the breeding season, SEP and DEP are of limited importance to offshore ornithology receptors that inhabit the wider SNS.

3.4.4 Further detailed analysis of the existing environment is provided in **Chapter 8: Benthic Ecology** (document reference 6.1.8), **Chapter 9: Fish and Shellfish Ecology** (document reference 6.1.9), **Chapter 10: Marine Mammal Ecology** (document reference 6.1.10), **Chapter 11: Offshore Ornithology** (document reference 6.1.11) and the **Stage 1 CSCB MCZ Assessment** (document reference 5.6).

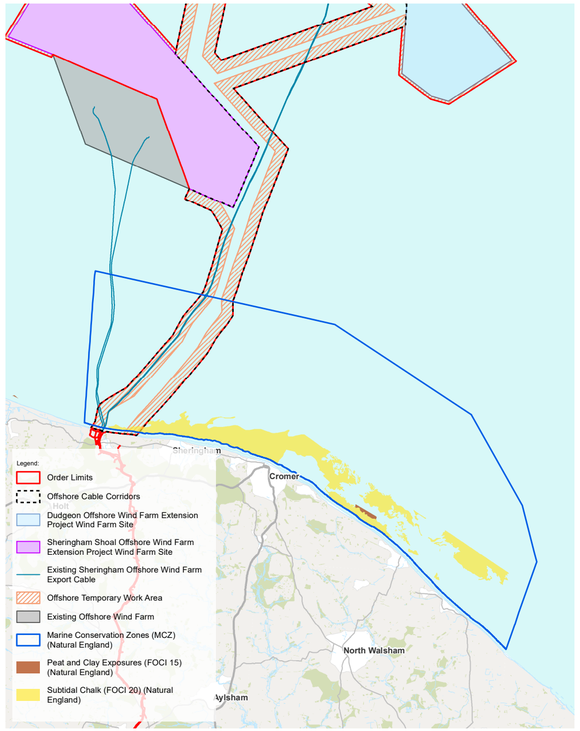

FIGURE 3.4 : Marine ecology and ornithology

FIGURE 3.5 : Existing views

3.5 Historic Environment

3.5.1 Although there are no known sea bed prehistory sites within the study area, the assessment has demonstrated the presence of palaeolandscape features and palaeoenvironmental deposits of interest for the study of submerged prehistoric landscapes. These formed during periods of low sea level when the area would have been exposed as a terrestrial landscape and are associated with the potential for prehistoric occupation and potential archaeological sites.

3.5.2 With respect to maritime and aviation archaeology, the assessment has demonstrated the presence of 550 sea bed features which have been identified as being of archaeological interest or potential archaeological interest. Whilst there are no known aircraft crash sites within the study area 16 wrecks have been confirmed within the geophysical data with 21 additional wrecks and obstructions listed by the UKHO within the Offshore Temporary Works Area. There are 221 further sea bed features of possible archaeological interest previously recorded within the Offshore Temporary Works Area where this overlaps with the surveyed footprint of the constructed DOW. In addition to these known wrecks and geophysical anomalies, there is also potential for the presence of further maritime and aviation archaeological remains which have not previously been identified.

3.5.3 The Historic Seascape of the study area is characterised by palaeolandscapes, historic fishing and navigation activities with more modern influences from the energy industry including the constructed SOW and DOW and the Elgood Wellhead and Blythe Platform (refer to **Figure 3.6**). The introduction of new offshore wind infrastructure into this seascape will result in a change to the existing character, although this limited change is accompanied by the accumulation of publicly available data acquired by the project prior to construction which is considered to be of public value.

3.5.4 Within the intertidal zone there are 45 records of heritage assets recorded by the Norfolk Historic Environment Record. These comprise findspots of Prehistoric, Roman and Medieval material from the beach although the majority of the records relate to former Post-Medieval, WWI and WWII defences and military infrastructure. There is potential for similar finds, including the eroded fragmentary remains of WWI and WWII defensive structures, to be present within the intertidal zone.

3.5.5 Further detailed analysis of the existing environment is provided in **Chapter 14 Offshore Archaeology and Cultural Heritage** (document reference 6.1.14).

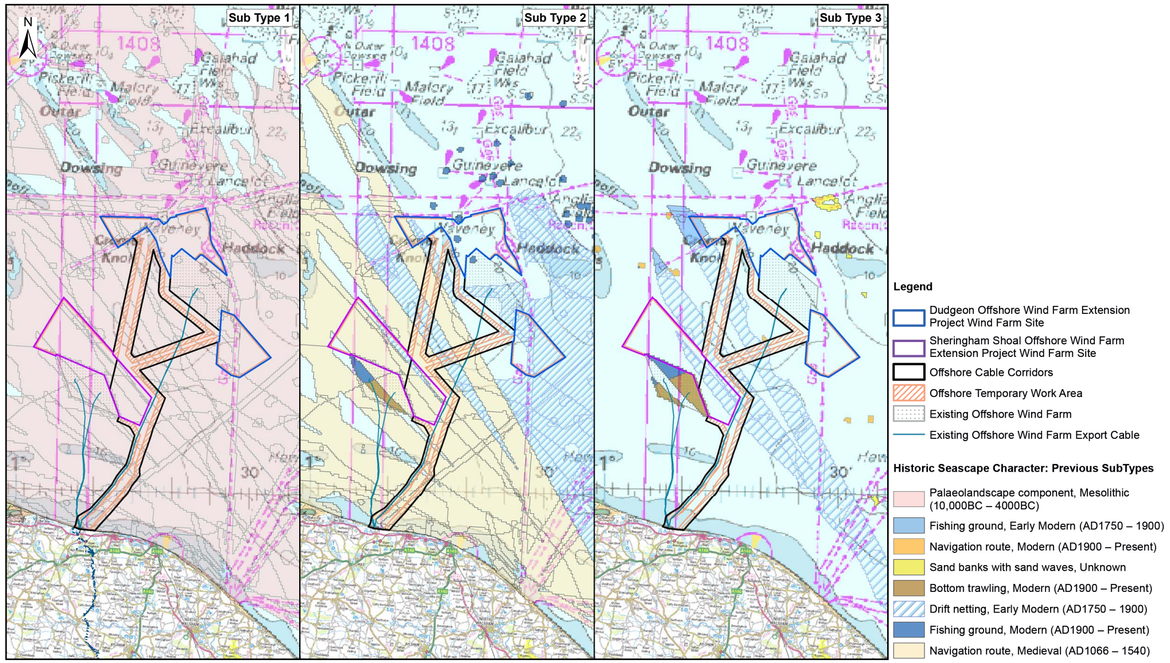

FIGURE 3.6 : Historic environment

3.6 Shipping & Navigation

3.6.1 **Figures 14.1 to 14.19 in Appendix 13.1 Navigation Risk Assessment** (document reference 6.1.13.1) show the pattern of vessel movement within the SEP and DEP study area based on 28 days AIS and radar survey data. A shipping route is evident between SEP and DEP, utilised primarily by commercial vessels, in addition to an inshore route south of SOW. **Figure 3.7** shows the main vessel routes in the vicinity of SEP and DEP.

3.6.2 On average, 82 unique vessels were recorded within the study area per day. The primary vessel types operating in vicinity of both SEP and DEP are cargo vessels, tankers and offshore support vessels operating to offshore oil and gas platforms and existing nearby wind farms.

3.6.3 On average 41 cargo vessels and 13 tankers per day were recorded within the study area. The majority of commercial vessels favour use of the route between SEP and DEP while smaller commercial vessels typically utilise the inshore route.

3.6.4 Between three and four passenger vessels per day were recorded transiting the study area. The passenger routes within the study area is utilised by P&O and Stena and on occasion DFDS for poor weather routeing.

3.6.5 Offshore support vessels within the study area are comprised of oil and gas and wind farm support vessels. Oil and gas traffic is primarily in close proximity of DEP, typically routeing to the Waveney, West Sole or Pickerill gas fields. The wind farm support vessels are typically operating to the SOW or DOW sites or nearby Race Bank.

3.6.6 An average of three vessels per day were recorded in the study area. Fishing vessels were noted both on transit and actively engaged in fishing. Vessels engaged in fishing tended to be in closer proximity to SEP.

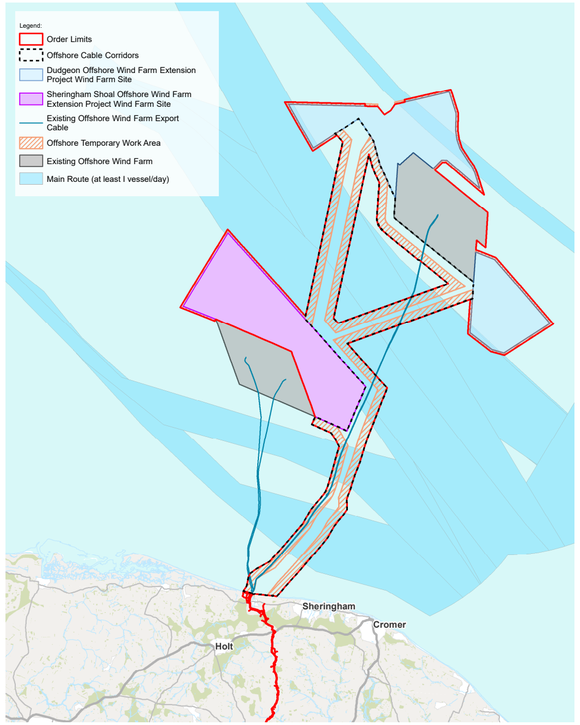

FIGURE 3.7 : Shipping & navigation

3.6.7 On average, one recreational vessel transited the study area per day, with the greatest concentration close to the coast. Recreational vessels show the greatest seasonality with all tracks detected during the summer survey. A general boating area exists along the coast to the south of SEP.

3.6.8 Othervessels identified include dredgers transiting to dredging areas to the south west of SEP, with the majority passing to the south of SEP.

3.6.9 One charted anchorage is located within the southern extent of the study area near Cromer. There were 46 cases of anchored vessels within the study area over the 28day period. The majority of these were observed to be related to oil and gas activities (48%), however, cargo vessels, tankers, wind farm support (near Race Bank) and marine aggregate dredgers were also recorded, primarily close to shore.

3.6.10 There are no military practice and exercise areas or marine environmental high-risk areas within the study area.

3.6.11 Further detail on the existing environment is contained within **Chapter 13 Shipping and Navigation and Appendix 13.1 Navigation Risk Assessment** (document reference 6.1.13 and 6.1.13.1)**.**

4.0 Delivering Good Design

4.0 Delivering Good Design

4.1 What is Good Design?

4.1.1 In the United Kingdom the design of infrastructure projects is the subject of key policy documents and guidance notes, which have been used to help inform the principles of 'good design'. These include the Overarching National Policy Statements for Energy (EN-1) (2011) and Renewable Energy (EN-3) (2011), the emerging draft Overarching NPS for Energy (EN-1) (2021), the National Infrastructure Commission's 'Design Principles for National Infrastructure' report (2020) and NatureScot's Siting and Designing Wind Farms in the Landscape Guidance (2017).

4.1.2 Overarching National Policy Statements for Renewable Energy (EN-3) (2011) states that *"Proposals for renewable energy infrastructure should demonstrate good design in respect of landscape and visual amenity, and in the design of the project to mitigate impacts such as noise and effects on ecology."*

4.1.3 The draft Overarching National Policy Statement for Energy (EN-1) (2021) states that *"the visual appearance of a building, structure, or piece of infrastructure, and how it relates to the landscape it sits within, is sometimes considered to be the most important factor in good design. But high quality and inclusive design goes far beyond aesthetic considerations … [good design of energy projects] should produce sustainable infrastructure sensitive to place, efficient in the use of natural resources and energy used in their construction and operation, matched by an appearance that demonstrates good aesthetic as far as possible."*

4.1.4 The draft NPS for Energy further highlights the need to consider good design from the early stages of a project stating that *"Design principles should be established from the outset of the project to guide the development from conception to operation.'*

4.1.5 In line with NPS this document sets out how the SEP and DEP proposals will fulfil the criteria of good design and are informed by the overarching project vision and objectives identified in **Section 2**.

4.1.6 While the focus of this report is on the planning stages, the project vision and objectives will equally apply to any future stages of the project, including detailed design.

4.2 Sustainable Design

4.2.1 SEP and DEP are expected to be operational for 40 years and will represent a significant contribution towards net zero targets over the majority of the lifetime of the projects.

4.2.2 The Applicant has undertaken a **Greenhouse Gas Assessment** (document reference 9.2) that provides a quantified assessment of greenhouse gas emissions over the lifetime of SEP and DEP.

4.2.3 The assessment considered emissions from the extraction and manufacture of equipment and materials, marine vessel and road traffic movements, and the use of plant and equipment.

4.2.4 Greenhouse gas emissions from construction, operation and decommissioning of the SEP or DEP. DEP in isolation are predicted to be 0.69 and 0.82 million tonnes of CO_2e, respectively. Both SEP and DEP concurrently scenarios are anticipated to release 1.39 – 1.48 million tonnes CO_2e, depending on whether the projects are concurrent or sequential. The largest GHG contribution to SEP and DEP is embodied emissions within materials to be used during construction, particularly in the offshore components of the project.

4.2.5 The greenhouse gas intensity of energy produced by SEP and DEP project anticipated to range between 8.9 to 10.2 g CO_2e/kWh depending on the scenario constructed. This is around the midrange of previous studies for offshore wind farms and therefore the GHG payback of emissions is likely to be less than 1.1 years from when SEP and DEP start to produce electricity for the UK grid.

4.3 Consultation

4.3.1 The Applicant has undertaken an extensive programme of community and stakeholder consultation to inform the EIA process and the design of SEP and DEP. This has included consultation with Expert Topic Groups (ETG), as detailed in the ES topic chapters, where the design of various elements was discussed. As an example, offshore windfarm layout was discussed several times at the landscape ETG meetings.

4.3.2 The **Consultation Report** (document reference 5.1) provides full details of the consultation process and includes a description of key design decisions that have been made by the Applicant as a result of feedback received to dat. Details of how the Applicant has taken account of the comments received are also provided in each assessment topic chapter of the ES where relevant.

4.3.3 A summary of the most salient design decisions that have been made by the Applicant as a result of the consultation process relating to the offshore works are summarised below:

- The intention to coordinate the development of SEP and DEP as far as possible with the preferred option of developing the integrated electrical infrastructure system (providing transmission infrastructure which serves both of the wind farms) which would be constructed concurrently. This benefits the planning and construction of the electrical infrastructure system, is likely to reduce overall levels of environmental impact and disruption, and helps to respond to any concerns regarding the lack of a holistic approach to offshore wind development.
- The removal of the 14MW wind turbine option from the envelope, reducing the total maximum number of wind turbines across SEP and DEP from 56 to 53.
- An increase in the minimum air gap from 26m to 30m to reduce impacts on ornithology through a reduction in predicted collision risk.
- Selection of the landfall at Weybourne with an export cable corridor through the western portion of the MCZ. This avoids the Wash and North Norfolk Coast Special Area of Conservation (SAC) and reduces the overall length of the export cable corridor.
- Committed to bury the export cables as far as possible and to no more than 100m of external cable protection per export cable in the MCZ (for unburied cables (i.e. up to 1,200m2), excluding that required at the HDD exit point (i.e. up to 600m2). This reduces the extent of any longer-term impacts on the MCZ.
- Commitment to not using loose rock type external cable protection systems in the CSCB MCZ. This facilitates the possibility of removal on decommissioning.

- Should a plough be selected as the appropriate burial tool for the SEP and DEP export and/or interlink cables, a non-displacement type will be used to minimise environmental impact.
- Use of long HDD at the landfall (exiting approximately 1,000m from the coastline) in order to avoid works such as trenching on the beach and cliffs and the complete avoidance of the sensitive outcropping chalk feature in the nearshore section of the MCZ.
- Committed to a Navigational Management Plan (NMP) in response to concerns from local operators on the increased number of route deviations.

4.4 Design Evolution and Process

4.4.1 The design proposals for SEP and DEP have been developed through a series of clearly defined stages which were closely were aligned to the pre-application consultation process. These are defined as follows:

- Agreement for Lease Area Definition – 2018 to 2019
- Phase 1 Consultation – July 2020 to August 2020
- Phase 2 Consultation – April 2021 to June 2021
- Temporary Offshore Works Area Targeted Consultation – April and 18 May 2022
- DCO submission – Q3 2022

4.4.2 Pre-application consultation is a legal requirement for NSIPs and an important part of the design process. Equinor has consulted the local community, statutory bodies and other relevant stakeholders on its development proposals in accordance with the requirements of the Planning Act 2008.

4.4.3 The comments received at each stage of the consultation were recorded, analysed and used to inform the evolution of the proposals. Full details can be found in the **Consultation Report** (document reference 5.1) submitted as part of this application.

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5.0 Agreement for Lease Area Definition

5.0 Agreement for Lease Area Definition

5.1 Overview

5.1.1 In 2018 The Crown Estate (TCE) invited developers to bid for extensions to operational offshore wind farms.

5.1.2 The existing Sheringham Shoal and Dudgeon Offshore Wind Farms are owned by different partners, with Equinor New Energy Limited being the only partner with ownership in both projects.

5.1.3 Equinor New Energy Limited (the Applicant) applied, on behalf of the partners in the operational Sheringham Shoal and Dudgeon Offshore Wind Farms, for an AfL for the extension of these two wind farms. An acceptance letter from TCE was received in September 2019 and AfLs were signed in April 2020 for DEP and August 2020 for SEP.

5.1.4 The AfL boundaries have not changed since the original submission and are the basis of the SEP and DEP wind farm array boundaries contained within this DCO application. A description and justification of the AfL boundaries is provided below.

5.2 Initial Site Selection

5.2.1 The AfL applications submitted by the Applicant identified Areas of Interest (AoI) for each of the proposed wind farm extensions. Key TCE criteria that influenced the site selection process dictated that wind farm extensions must share a boundary with the existing (parent) wind farm; and that other than the existing wind farm, the proposed extension/s must not encroach within a radius of 5km of any other wind farm (unless the tenant of any such wind farm had confirmed its agreement otherwise). In addition, the TCE application criteria required that the existing wind farm proposed to be extended must be constructed and fully operational at the date of the application and the capacity in megawatts of the proposed extension must not exceed that of the existing wind farm. Equinor also took into account the requirement for the size of the proposed extension to be of an appropriate scale to the existing site, and to only apply for an area that was necessary and proportional to the installed capacity, taking account of necessary flexibility.

5.2.2 In order to identify AoIs, the Applicant developed and applied the following overarching site selection criteria as part of its early design development, reflecting TCE requirements and a respectful approach to context:

- No nearer than 5km from the proposed Race Bank OWF extension;
- Avoid areas that are not feasible in terms of geology and bathymetry;
- Minimise cable and pipeline crossings;
- Distance to shore (no closer inshore than the existing Sheringham Shoal OWF to limit potential landscape impacts);
- Water depths greater than 10m;
- Avoiding existing shipping lanes and areas of high shipping density;
- Maximise the benefits of the prevailing wind direction;
- Minimise wake effects on operational wind farms;
- Avoid wind farm area in marine nature conservation designations;
- Minimise the disruption to existing infrastructure and other marine users;
- Shortest and most direct route for the export cables to reduce environmental impacts, transmission losses and costs by minimising footprint for both the offshore and onshore cable routes;
- Routeing options need to be able to connect to viable landfall locations; and
- Avoidance of key sensitive features where possible and where not possible, to minimise and mitigate impacts as appropriate.

5.2.3 Using the criteria identified above, AoIs were identified for both SEP and DEP and included in the submitted AfL applications. A detailed description of the AoI boundaries is provided below with further information provided in **Chapter 3 Site Selection and Assessment of Alternatives** (document reference 6.1.3).

5.3 Dudgeon Extension Area of Interest

5.3.1 At the AfL stage, applications were made for two distinct wind farm sites for DEP to provide the necessary flexibility and a sufficiently large area to achieve the required generating capacity. The AfL areas therefore comprise the DEP North array area, an extension to the northwest, and the DEP South array area, an extension to the southeast (refer to **Figure 5.1**).

5.3.2 Further to the TCE criteria outlined above, the key factors in the selection of the DEP North array area boundaries were:

- The northern boundary is defined by gas pipeline PL27 running between the Viking gas field in the east and the Theddlethorpe Gas Terminal on the Lincolnshire coast to the west, and diverts to avoid the Perenco-operated Waveney gas platform and its 500m safety zone.
- The eastern boundary is defined by the Esmond to Bacton gas pipeline running between the Esmond gas field in the north and the Bacton Gas Terminal to the south on the Norfolk coast.
- The western boundary is defined by a shipping lane between the existing Dudgeon and Sheringham Shoal OWFs as indicated by Automatic Identification System (AIS) data from 2016 and 2017 (further details in **Chapter 13: Shipping and Navigation**).
- A gap was left between the DEP North array area and the existing DOW northern boundary to avoid potential conflict with a planned oil and gas development by Independent Oil and Gas Plc. Approvals are in place for installation and operation of a normally unmanned production platform, Blythe, and an additional subsea well, Elgood, to be tied back to Blythe. Elgood and Blythe would be located adjacent to the north eastern and eastern boundaries respectively of the Dudgeon OWF, connected by a production pipeline around the DOW boundary.
- A shallow area (part of Cromer Knoll sandbank) to the north west of the existing DOW was excluded from the DEP North array area boundary for technical reasons due to the shallow water depth and bathymetry, which were considered unsuitable for foundation and cable installation. In addition, Natural England advised (during a meeting held 29th January 2018) that this shallow area was believed to

be important for feeding birds and that it would therefore be of benefit to exclude the area from development. Following the bathymetry analysis, engineering review and the advice from Natural England, this area was removed from the southern boundary of the DEP North array area.

5.3.3 Key factors in the selection of the DEP South array area boundaries were:

- The shipping lane between the existing SOW and DOW, limiting extension to the south and west.
- Although it was considered preferable to avoid the Esmond to Bacton gas pipeline, it traverses the DEP South array area. Detailed design and layout of turbines will avoid the pipeline and infield cables will be arranged to minimise the number of pipeline crossings.

5.4 Sheringham Shoal Extension Area of Interest

5.4.1 Further to the TCE criteria outlined above, the key factors in the selection of the SEP wind farm site boundary were:

- Following submission of the application for AfL to TCE, the Applicant was informed of an application to extend the Race Bank OWF from its eastern boundary. Therefore, principles for the distance between the extensions were agreed with the Race Bank OWF developer (Ørsted) and TCE allowed the Applicant to redefine the extension boundary. The proposed western extension of Sheringham Shoal was limited in order to leave a 5km buffer from the proposed Race Bank OWF extension AoI in accordance with TCE's constraints criteria.
- The existing Sheringham Shoal OWF is located 17km north of the seaside town of Sheringham at its nearest point to the shore. Zones of Visual Influence (ZVIs) generated for the existing wind farm were studied, suggesting that the wind turbines are visible within 35km and that beyond this distance potential effects would not be significant. The Sheringham Shoal OWF Visual Impact Assessment showed that the wind farm is potentially visible from the North Norfolk coast between Brancaster in the west and Walcott in the east. Assessment of the closest coastal viewpoints between 17km and 19.5km distant suggested that the wind farm is visible 63% of the time, decreasing with increasing distance beyond these viewpoints (Scira Offshore Energy Ltd, 2006). An extension to the south and closer to shore than the existing wind farm was therefore ruled out to minimise potential visual impacts.
- The eastern boundary of the SEP wind farm site is defined by the route of the existing DOW export cables.
- The northern boundary of the SEP wind farm site is constrained by the shipping lane between the existing SOW and DOW.

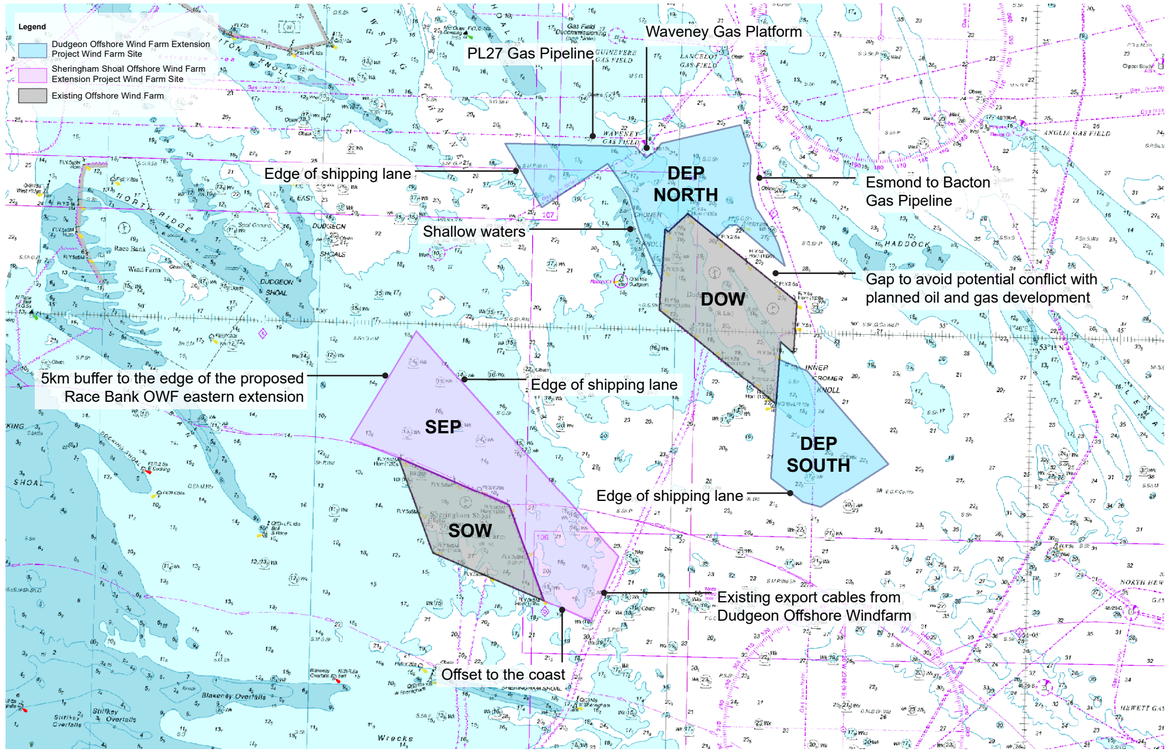

FIGURE 5.1 : Agreement for lease area definition

6.0 Layout

6.0 Layout

6.1 Introduction

6.1.1 The final layout of the projects will not be finalised until completion of detailed pre-construction wind resource studies, site investigations and the selection of the preferred turbines and their foundations.

6.2 Layout Commitments

6.2.1 The final layout of the offshore wind farm infrastructure will be in accordance with the layout commitments that have been agreed in consultation with the Maritime and Coastguard Agency (MCA) and Trinity House (TH). These Layout Commitments have been developed in accordance with the guidance contained within the Marine Guidance Note (MGN 654) and are presented in **Appendix 13.1 Navigation Risk Assessment** (document reference 6.3.13.1).

6.2.2 A summary of the layout commitments is provided in **Table 6.1**.

COMMITMENT	DESCRIPTION
1	The The project will undertake a thorough appraisal of the potential for two consistent lines of orientation. Should two consistent lines not be possible, as a minimum the position of surface structures shall be arranged in straight lines with at least one consistent line of orientation with the exact locations to be determined with consideration of micro siting allowances agreed in consultation with the MCA (see Commitment 4). The spacing between these straight lines shall comply with MGN 654 (i.e., SAR lanes will be at least 500m in width tip to tip).
2	Where practically possible, the position of surface structures shall be aligned with existing lines of orientation of the nearest operational wind farm. Otherwise, the position of surface structures will be arranged as stated in commitment 1 with the modification that a minimum spacing of 1 nautical mile tip to tip will be maintained between the turbines of the nearest operational wind farm and the turbines of SEP and DEP.
3	The position of all structures along the perimeter will be arranged such to aid visual navigation and avoid outliers as far as is practicable within the shape of the Red Line Boundaries. They will be arranged in straight lines along the perimeter where practically possible.
4	Tolerance of ±150 metres (inclusive of a 50m micrositing value in any direction) may be used in agreement with the MCA and will avoid placement of structures which impact on minimum SAR Access Lanes widths (i.e., any tolerance / micrositing applied will not reduce SAR lanes below 500m minimum in width) or result in dangerously protruding structures.

TABLE 6.1: Layout commitments

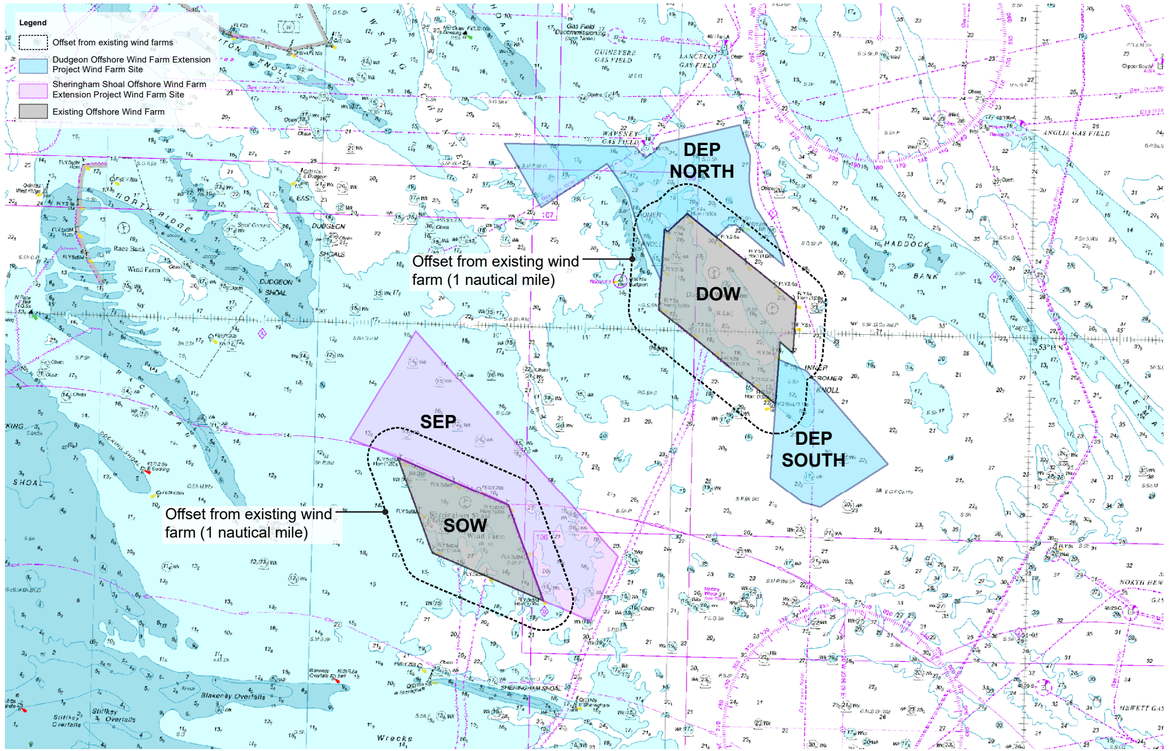

FIGURE 6.1 : Plan showing 1 nautical mile offset from existing wind farms

6.3 Identification of the Final Layout

6.3.1 A layout will be selected from within the consented parameters to optimise energy output and the foundation installation process, accounting for water depths, ground conditions, wake effects and any other constraints.

6.3.2 Determination of the final layout will be dependent on a range of factors including:

- Further survey work
- Selection of the Wind Turbine Generators
- Detailed engineering
- Engagement with MCA and Trinity House on final layout
- Compliance with DCO Requirement / DML conditions

6.3.3 A key consideration of the final layout for SEP and DEP will be the relationship with the existing wind farms at SOW and DOW. The wake downstream of a turbine rotor is characterised by decreased wind speed and increased turbulence compared to the flow upstream of the rotor, and wake effects can be detected at a distance of up to 20 rotor diameters. An optimum layout will ensure that the flow in front of a wind turbine is affected as little as possible by wake effects from existing and proposed wind turbines.

6.3.4 Whilst the technical, economic and safety requirements of the projects will take precedent in refining the final layout, other considerations, guided by the Project Vision and Design Objectives, may include the potential effects upon seascape, landscape and visual receptors. Where practicable, noting MGN 654 requirements and the Layout Commitments (see **Section 6.2**), the Applicant would seek to produce a layout which achieves the following objectives:

- Produce visually balanced and coherent layout of turbines when seen from key viewpoints, demonstrating a good rhythm, spacing;
- Achieve an appropriate scale in terms of distribution of turbines in relation to the coastal topography;
- Achieve simple visual relationship with skyline, avoiding variable spacing and overlapping of turbines within an array or significant outliers; and
- Achieve satisfactory visual relationship (balanced, ordered, coherent and clearly legible) with existing arrays.

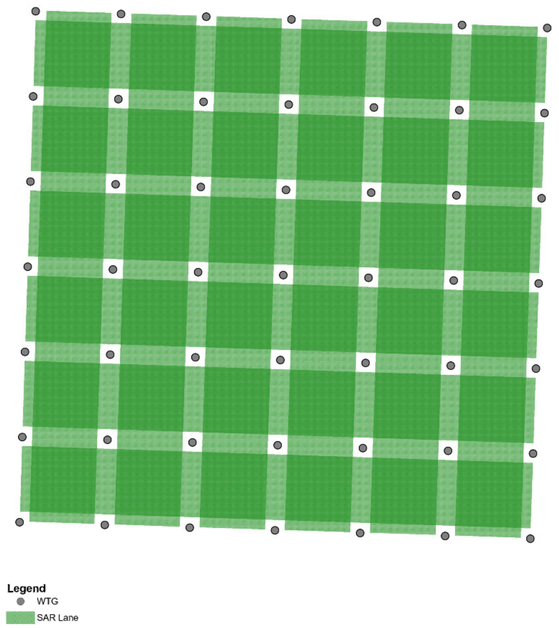

FIGURE 6.2 : Example layout based on multiple lines of orientation

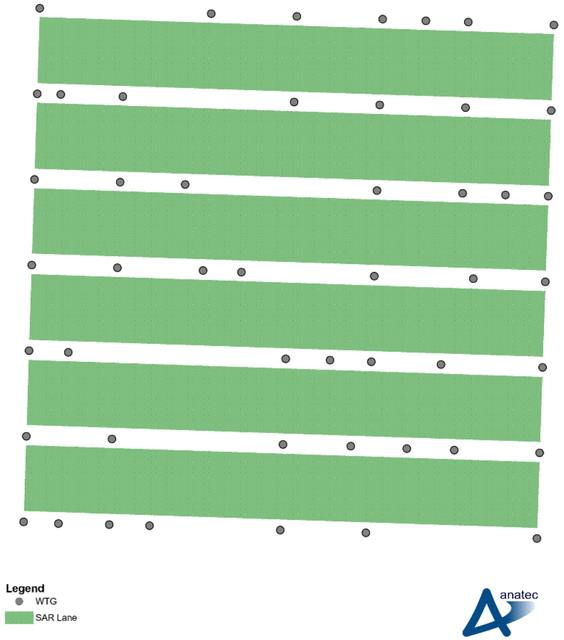

FIGURE 6.3 : Example layout based on single line of orientation

7.0 Wind Turbine Generators

7.0 Wind Turbine Generators

7.1 Overview

7.1.1 SEP will consist of between 13 and 23 wind turbines, each having a rated electrical capacity of between 15MW and 26MW. DEP will consist of between 17 and 30 wind turbines, each having a rated electrical capacity of between 15MW and 26MW. Taken together, there will be between 30 and 53 wind turbines. The locations of the SEP and DEP wind farm sites and offshore cable corridors are shown on **Figures 1.1 and 1.2**.

7.2 Wind Turbine Parameters

7.2.1 The project design envelope includes a range of turbines from 15MW to 26MW capacity in order to accommodate the ongoing rapid development in wind turbine technology. Wind turbine parameters are summarised in **Table 7.1**, with key dimensions shown on **Figure 7.1**.

7.2.2 Following consultation feedback, the Applicant has committed to a 30m air gap (between the lower blade and Highest Astronomical Tide (HAT)). This is greater than the standard 22m air gap required and is intended to provide further reduction of potential collision risk.

PARAMETER	MINIMUM	MAXIMUM
Rotor diameter (m)	235	300
Rated power (MW)	15	26
Units SEP	13	23
Units DEP	17	30
Rotor swept area DEP (km2)	1.20	1.30
Rotor swept area SEP (km2)	0.92	1.00
Rotor swept area total (km2)	2.12	2.30
Tip height above HAT (m)	265	330
Lower blade above HAT (the 'air gap') (m)	30	30
Rotor cut-in/cut-out wind speed (m/s)	3 to 38	3 to 38
Indicative separation distance between turbines (inter-row and in-row) (expressed as a multiplication of rotor diameter)	4.5	11
Indicative separation distance between turbines (inter-row) and between turbines in rows (in-row) (km)	1.05	3.3

TABLE 7.1: Key wind turbine parameters

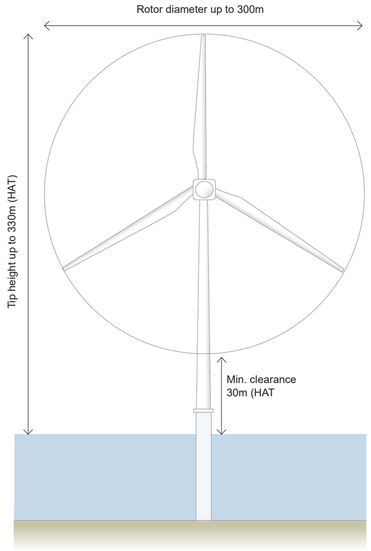

FIGURE 7.1 : Wind turbine schematic

7.3 Navigation Lighting Requirements and Colour Scheme

7.3.1 With respect to lighting and marking, the wind turbines and the OSP topsides will be designed and constructed to satisfy the requirements of the Civil Aviation Authority (CAA), MCA, TH, and the Ministry of Defence (MOD) as required. As such exact lighting arrangements and design are not identified at this stage.

7.3.2 The wind farm sites are located adjacent to the existing wind farms of Sheringham Shoal and Dudgeon. It is anticipated that any additional lighting produced would not be dissimilar to the lighting produced by the existing wind farms and will be developed in consultation with the relevant authorities during the detailed design of SEP and DEP.

7.3.3 Further details including reference to the relevant guidance and regulations is presented in **Chapter 13 Shipping and Navigation** (document reference 6.1.13) and **Chapter 15 Aviation and Radar** (document reference 6.1.15).

7.3.4 The scheme for nacelles, blades and towers is expected to be RAL 7035 (light grey) and foundation steelwork RAL 1023 (traffic yellow) from HAT up to a minimum of 15m, to be determined by the relevant requirements and guidance at the time. **Figure 7.2** illustrates the typical colour scheme envisaged for SEP and DEP.

FIGURE 7.2 : Turbine colours / lighting

8.0 Electrical Infrastructure

8.0 Electrical Infrastructure

8.1 Overview

8.1.1 National Policy Statement for Electricity Networks Infrastructure (EN-5) (2011) refers to Section 4.5 of EN-1 which sets out the principles for good design that should be applied to all energy infrastructure. Draft NPS EN5 also highlights the fact that the functional design constraints of safety and security may limit an applicant's ability to influence the aesthetic appearance of electrical infrastructure. Good Design including the avoidance and/or mitigation of potential adverse impacts has been applied in the design of the electrical infrastructure for the project wherever possible, albeit recognising the functional performance of the infrastructure in respect of security of supply and public and occupational safety must not thereby be threatened, as highlighted in the Draft NPS. Some aspects of the design of the electrical infrastructure are described below.

8.2 Cables

8.2.1 The offshore cable infrastructure is described in the **ES Chapter 4 Project Description** (document reference 6.1.4). The design of the electrical infrastructure has responded to the sensitive nature of the seabed by minimising the number of cables and careful routing. The primary method for protecting cables will be via burial. Typical burial depth for SEP and DEP cables, excluding in areas of sand waves, is expected to be between 0.5m to 1.5m (or up to 1m for the export cables), although in challenging ground conditions the required depth of burial may not be achieved. In this event, the installation of external cable protection would be considered.

8.2.2 Infield cables link the wind turbine generators to the OSP/s. Cable system design will be based on radial strings from the OSP/s and connecting multiple turbines per string. The number of infield cables will be equal to the number of turbines, whilst the length of each cable, and string, will depend on the distance between the turbines and the distance between the first turbine on the string and the OSP.

8.2.3 Cable circuits (strings) will be optimised according to the electrical load they are required to carry, with up to three different cable dimensions being used. They will be integrated with fibre optic cables.

8.2.4 Each infield cable will be installed in its own trench, with the maximum length of infield cables being 225km (90km at SEP, 90km in the DEP North array area and 45km in the DEP South array area).

8.3 Offshore Substation Platform/s

8.3.1 The infield (array) cables from each string of turbines will be brought to an OSP, located appropriately to optimise the infield, interlink and export cable lengths.

8.3.2 There will be up to two OSPs, depending on how SEP and DEP are developed. In the case that two OSPs are constructed there will be one in the DEP North array area and one in the SEP wind farm site. In the case that one OSP is constructed it will be located in the SEP wind farm site. The location of the OSP/s will be confirmed during the detailed design process, accounting for the wind turbine layout, but will be within the Order Limits (excluding offshore temporary works area) of each wind farm site.

8.3.3 The basic OSP design will consist of a topside structure configured in a multiple deck arrangement, with the decks either open with modular equipment, or fully clad. Weather sensitive equipment would be housed accordingly.

8.4 Offshore Export Cable Corridor and Landfall Site Selection

8.4.1 The route of the offshore export cable corridor and the location of landfall has been subject to an extensive site selection process (see **ES Chapter 3 Site Selection and Assessment of Alternatives**) considering environmental and technical constraints.

8.4.2 The proposed location for landfall is at Weybourne, to the west of Weybourne beach car park near to Mickleburgh Military Collection. This site has been selected for the following reasons:

- Considerablyflatter topography (8m cliffs at Weybourne compared to 32m high cliffs at other potential locations);
- Shorter export cable route, minimising the area of environmental impact;
- Good access using existing roads and tracks;
- Avoids the SSSI and any interaction with National Nature Reserves (NNR) along the Norfolk coast (e.g. Mundesley Cliffs SSSI and Paston Great Barn NNR);
- Avoids the Annex I habitats of The Wash and North Norfolk Coast SAC which are in unfavourable condition;
- Potential for long HDD technique at the landfall, avoiding impact to the chalk outcropping associated with the CSCB MCZ and Weybourne Cliffs SSSI;
- Located close to the existing Dudgeon and Sheringham Shoal HDD landfalls for which considerable experience, data and lessons learnt are available resulting in a high level of confidence in the engineering feasibility of landfall and HDD works at this location; and
- Private land along the beach for duct preparation (as was used during the construction of the Dudgeon OWF.

8.5 Offshore Export Cables

8.5.1 There will be up to two HVAC offshore export cables. For the majority of the cable corridor, each of the offshore export cables will be installed in a separate trench with a spacing of up to 100m between the cables, (where two export cables are installed in parallel) within a zone of 1000m-1700m between the adjacent temporary works areas either side of the cable corridor. The offshore Order Limits are designed to provide sufficient space for the cable trenches (including the potential need to micro-site the offshore export cable corridor around any sensitive features that are confirmed at the pre-construction stage), as well as all temporary works and any future operation and maintenance activities such as cable reburial or repairs. The greater width of offshore export cable corridor on approach to landfall is designed to provide greater flexibility in the detailed routeing/ micro-siting of the export cable/s at the pre-construction stage through the CSCB MCZ.

8.5.2 Within the intertidal zone, the Applicant has committed to the installation of offshore export cables via trenchless techniques (such as HDD) and thus avoiding damage to the chalk reefs.

9.0 Conclusion

9.1 Conclusion

9.1.1 This Offshore Design Statement forms part of a suite of supporting documents for the SEP and DEP DCO application, and sets out the approach to securing the delivery of good design in accordance with the Overarching National Policy Statement for Energy (EN-1) (2011) and the emerging draft Overarching NPS for Energy (EN-1) (2021).

9.1.2 The Applicant has clearly stated a commitment to good design quality based on a clear Project Vision, and a defined set of Design Objectives (described in **Section 2**) and layout commitments (**Section 6**) which have guided the initial site selection at the AfL stage and the design development process to date. This has ensured mitigation is at the heart of the SEP and DEP proposals, embedding environmental principles as part of good design.

9.1.3 The design has been informed by extensive statutory and non-statutory consultation with stakeholders to ensure amongst other things, that the appreciation of the site's varied context is agreed and that the Applicant has explored design flexibility and design rationale in an open and transparent manner. A summary of the key offshore design decisions that have been made by the Applicant as a result of the consultation process are provided in this document.

9.1.4 The design for the offshore works will set out to achieve a high standard of design whilst at the same time balancing the operational requirements of the works with the character and appearance of the existing environment.

9.1.5 The final design of SEP and DEP offshore works will depend on the final development scenario and confirmed through detailed engineering design studies that will be undertaken post-consent to enable the commencement of construction. The Applicant will continue to be dedicated to good design throughout this process and for the duration of the construction, operation and decommissioning of SEP and DEP.

References

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