Morecambe Offshore Windfarm: Generation Assets

Development Consent Order Documents

Volume 4

Design Statement

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Rev 01

MORECAMBE

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Glossary of Acronyms

AC	Alternating Current
AEZ	Archaeological Exclusion Zones
AfL	Agreement for Lease
APFP	The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009
AtNMP	Aids to Navigation Maintenance Plan
CA1	Calder Platform
CAA	Civil Aviation Authority
CBRA	Cable Burial Risk Assessment
CEA	Cumulative Effects Assessment
CMS	Construction Method Statement
CPC	South Morecambe Central Processing Complex
DC	Design Code
DCO	Development Consent Order
DML	Deemed Marine Licence
DP3	South Morecambe DP3 Platform
EIA	Environmental Impact Assessment
ES	Environmental Statement
GHG	Greenhouse Gas Emissions
HAT	Highest Astronomical Tide
HE	Historic England
HNDR	Holistic Network Design Review
HSEQ	Health, Safety, Environment and Quality
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IoMSPC	The Isle of Man Steam Packet Company
LAT	Lowest Astronomical Tide
LDNP	Lake District National Park
MCA(1)	The Maritime and Coastguard Agency
MCA(2)	Marine Character Area
MGN	Marine Guidance Note
MMO	Marine Management Organisation
MOD	Ministry of Defence

MP	Marine Plan
NIC	National Infrastructure Commission
NP	National Park
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
NSN	National Site Network
NSTA	North Sea Transition Authority
OLR	Offshore Licensing Round
OOMP	Offshore Operations and Maintenance Plan
OREI	Offshore Renewable Energy Installations
OSP(s)	Offshore substation platform(s)
OTNR	Offshore Transmission Network Review
OWF	Offshore Windfarm
PDE	Project Design Envelope
PEIR	Preliminary Environmental Information Report
PEMP	Project Environmental Management Plan
PEXA	Practice and Exercise Areas
PINS	Planning Inspectorate
SAC	Special Area of Conservation
SAR	Search and Rescue
SoS	Secretary of State
SPA	Special Protection Area
TCE	The Crown Estate
TEZ	Temporary Exclusion Zone
TH	Trinity House
TSS	Traffic Separation Scheme
UK	United Kingdom
UKHO	UK Hydrographic Office
WSI	Written Scheme of Investigation
WTG	Wind turbine generator
ZTV	Zone of Theoretical Visibility

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Glossary of Unit Terms

°	degree
km	kilometre
km^2	square kilometre
kV	kilovolt
m	metre
m^2	square metre
MW	megawatt
nm	nautical mile

Glossary of Terminology

Applicant	Morecambe Offshore Windfarm Ltd
Application	This refers to the Applicant's application for a Development Consent Order (DCO). An application consists of a series of documents and plans which are published on the Planning Inspectorate's (PINS) website.
Agreement for Lease (AfL)	Agreements under which seabed rights are awarded following the completion of The Crown Estate (TCE) tender process.
Climate change impact	An impact from a climate hazard which affects the ability of the receptor to maintain its functions or purpose.
Climate change resilience	The ability of a project and its receptors to prepare for, respond to, recover from and adapt to changes in the climate in a manner that ensures it retains much of its original function and purpose.
Dead wreck	Wrecks which have not been detected by repeated surveys and are therefore considered not to exist
Generation Assets (the Project)	Generation assets associated with the Morecambe Offshore Windfarm. This is infrastructure in connection with electricity production, namely the fixed foundation wind turbine generators (WTGs), inter-array cables, offshore substation platform(s) (OSP(s))[1] and possible platform link cables to connect OSPs.
Holocene	The Holocene is the current geological epoch. It began approximately 11,650 calibrated years Before Present (c. 9700 BCE), after the Last Glacial Period, which concluded with the Holocene glacial retreat.
Inter-array cables	Cables which link the WTGs to each other and the OSP(s).
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	The transmission assets for the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm. This includes the offshore substation platforms (OSP(s))[2], interconnector cables, Morgan offshore booster station, offshore export cables, landfall site, onshore export cables, onshore substations, 400 kilovolts (kV) cables and associated grid connection infrastructure such as circuit breaker infrastructure. Also referred to in this document as the Transmission Assets, for ease of reading.
Nacelle	The part of the turbine that houses all of the generating components.
Offshore export cables	The cables which would bring electricity from the offshore substation platform to the landfall.

[1] At the time of writing the Environmental Statement (ES), a decision had been taken that the Offshore Substation Platforms (OSPs) would remain solely within the Generation Assets application and would not be included within the Development Consent Order (DCO) application for the Transmission Assets. This decision post-dated the Preliminary Environmental Information Report (PEIR) that was prepared for the Transmission Assets. The OSPs are still included in the description of the Transmission Assets for the purposes of this DCO document as the Cumulative Effects Assessment (CEA) carried out in respect of the Generation/Transmission Assets is based on the information available from the Transmission Assets PEIR.

Offshore substation platform(s)	A fixed structure located within the windfarm site, containing electrical equipment to aggregate the power from the WTGs and convert it into a more suitable form for export to shore.
Platform link cable	An electrical cable which links OSPs.
Safety Zone	An area around a structure or vessel which should be avoided, as set out in Section 95 of the Energy Act 2004 and the Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007.
Study area	This is an area which is defined for each Environmental Impact Assessment (EIA) topic which includes the offshore development area as well as potential spatial and temporal considerations of the impacts on relevant receptors. The study area for each EIA topic is intended to cover the area within which an effect can be reasonably expected.
Windfarm site	The area within which the WTGs, inter-array cables, OSP(s) and platform link cables will be present.
Wind turbine generator (WTG)	A fixed structure located within the windfarm site that converts the kinetic energy of wind into electrical energy.

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1 Introduction

1.1 About the Applicant

1. The Applicant is Morecambe Offshore Windfarm Ltd, a joint venture between Zero-E Offshore Wind S.L.U. (Spain) (a Cobra group company), and Flotation Energy Ltd (Flotation Energy).

2. With 80 years of experience, Cobra is a historically significant Group in the development of industrial infrastructure and service provision, and one of the key players in the renewable energy sector in Spain and Latin America. The Group possesses the capacity and determination to develop, build, and operate industrial and energy infrastructures that demand a high level of service, grounded in excellence in integration, technological innovation, and financial robustness. Their unrivalled knowledge and understanding of floating offshore wind developments is a significant advantage in delivering high quality and efficient projects, coupled with their commitment to environmental stewardship. Their experience as a major player in offshore wind is based on a 50MW project in operation and over 11.2GW under development.

3. Flotation Energy, headquartered in Edinburgh, Scotland, sits at the heart of the energy transition. It's determined to support the big switch to sustainable, clean and affordable energy through the application of innovative offshore wind technology. An ambitious offshore wind developer, Flotation Energy has a 13GW portfolio that covers both fixed and floating developments globally, with projects in the UK, Ireland, Taiwan, Japan and Australia. Whilst Flotation Energy develops projects independently, it also recognises the strategic value of partnership and collaboration to deliver proven, cost-effective solutions.

1.2 Purpose of this document

4. This document, **Design Statement** (Document Reference 4.3), forms part of the Development Consent Order (DCO) application for the proposed Project.

5. This document has been prepared pursuant to Regulation 5(2)(q) of The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 and forms part of a suite of supporting documents for the DCO application.

6. This document demonstrates how the Applicant has:

   - Met the requirements of good design stipulated in the National Policy Statements (NPSs) EN-1 and EN-3 and the Northwest Inshore and Offshore Marine Plan (MP)

- Established a set of design principles to guide design from the outset of the Project
- Has considered site constraints and consultation responses
- Has embedded good design during the iterative process of selecting site and refining the site boundary
- Has championed good design across multiple disciplines
- Will ensure the principles of good design are maintained post-consent and throughout the detailed design process

7. This document should be read in conjunction with **Chapter 4 Site Selection and Assessment of Alternatives** (Document Reference 5.1.4) and **Chapter 5 Project Description** (Document Reference 5.1.5) of the Environmental Statement (ES).

1.3 Document structure

8. An outline of the structure of this Design Statement document is set out below:

- **Site Context:** sets out the enviromental and physical attributes of the Project and surrounding area **(Section 2)**
- **Good Design Policy Context:** sets out the relevant policies, criteria for good design and guidance when planning for offshore renewable energy infrastructures **(Section 3)**
- **Design Framework:** establishes the framework within which good design of the Project has been established, including the Project vision, the Project's objectives and its design principles **(Section 4)**
- **Design Approach and Evolution:** demonstrates how the design of the Project has responded to the environment and consultation responses **(Section 5)**
- **Securing Good Design Post-Consent**: demonstrates how good design will be maintained in the post consent detailed design stage **(Section 6)**

1.4 Project overview

9. The Project is located entirely offshore in the Eastern Irish Sea and when fully operational, the Project is anticipated to generate a nominal capacity of 480MW. It is located approximately 30km, from the nearest point of the site to the Lancashire Coast, 58km, from the coastline of the Isle of Man, 37km from the UK and the Isle of Man's jurisdiction boundary, and 50km from the north coast of Wales. **Plate 1** shows the location of the Project.

10. The Project relates only to the Generation Assets of the Morecambe Offshore Windfarm (including wind turbine generators, inter-array cables, offshore substation platform(s), and possible platform link cables to connect

offshore substation platforms). A separate consent for the Transmission Assets associated with the Morecambe Offshore Windfarm and the Morgan Offshore Wind Project (another proposed windfarm to be located in the Irish Sea) will be sought, as explained below.

11. Both the Morecambe Offshore Windfarm and the Morgan Offshore Wind Project have been scoped into the Pathways to 2030 workstream, under the Offshore Transmission Network Review (OTNR). Under the OTNR, the National Grid Electricity System Operator is responsible for conducting a Holistic Network Design Review (HNDR) to assess options to improve the coordination of offshore wind generation connections and transmission networks. In July 2022, the UK Government published the Pathway to 2030 Holistic Network Design documents, which set out the approach to connecting 50GW of offshore wind to the UK electricity network (National Grid ESO, 2022). The output of this process concluded that the Morecambe Offshore Windfarm and the Morgan Offshore Wind Project should work collaboratively in connecting the windfarms to the National Grid at Penwortham in Lancashire. The Applicant was involved in this process and supports this decision.

12. The Transmission Assets, which will enable export of electricity from both the Morecambe Offshore Windfarm and the Morgan Offshore Wind Project to the National Grid connection point, will be subject to consent under a separate DCO Application. The Transmission Assets comprise OSPs for both the Morecambe Offshore Windfarm and the Morgan Offshore Wind Project[3], shared offshore export cable corridors, their landfall arrangements, shared onshore export cable corridors to new onshore substation(s), and onward connection to the National Grid electricity transmission network at Penwortham, Lancashire. An offshore booster station may also be required along the offshore export cable route for the Morgan Offshore Wind Project. The coordination of the Project with other projects and the benefits that secures, is key to delivering on the stated "*Coordination*" objective (4) of the Project.

[3] At the time of writing, a decision had been taken that the OSPs would remain solely within the Generation Assets application and would not be included within the DCO application for the Transmission Assets. This decision post-dated the Preliminary Environmental Information Report (PEIR) that was prepared for the Transmission Assets. The OSPs are still included in the description of the Transmission Assets for the purposes of this document as the Cumulative Effects Assessment (CEA) carried out in respect of the Generation/Transmission Assets is based on the information available from the Transmission Assets PEIR.

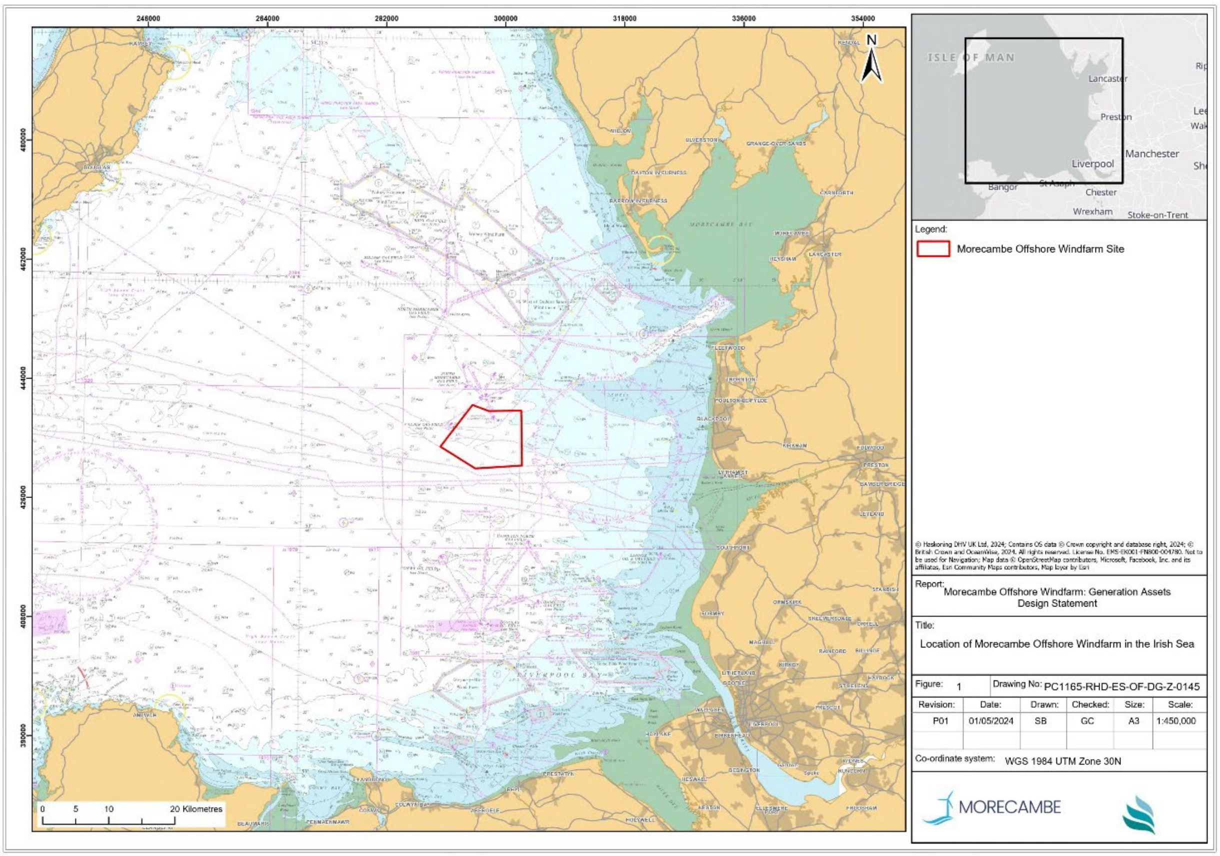

Plate 1 Location of the Project in the Eastern Irish Sea

13. **Section 1.5** of this document describes other offshore wind development projects located within the Irish Sea, including details of the Transmission Assets which would transmit the electricity generated from the Project onshore to the National Grid for distribution and consumption.

14. **Plate 2** illustrates the schematic components of this Project (Generation Assets) in blue and the components for the Transmission Assets in green (which will be subject of a separate DCO application).

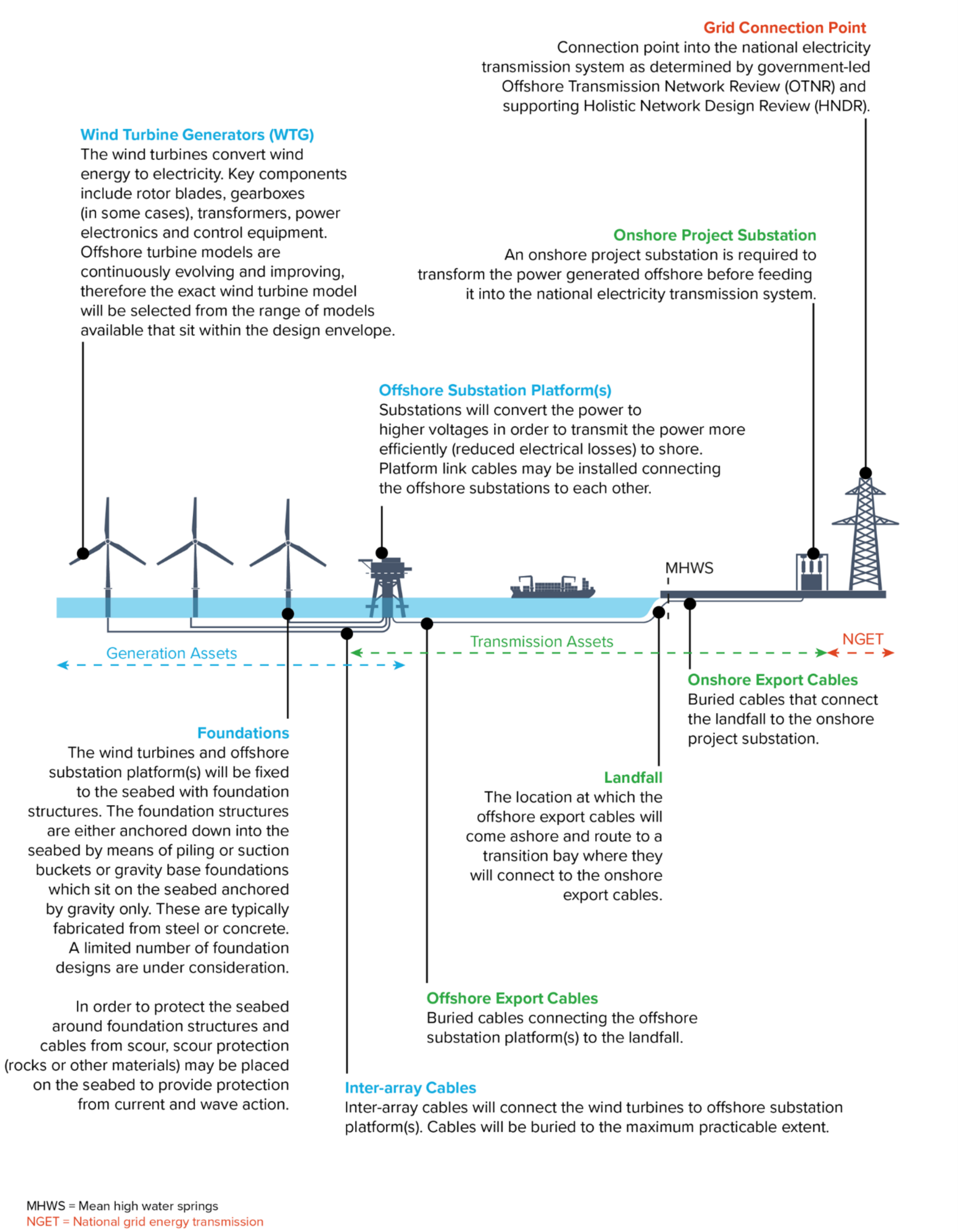

Plate 2 Components of Morecambe Offshore Windfarm Generation Assets ('the Project') are in blue. The components of Morgan and Morecambe Offshore Wind Farm: Transmission Assets ('Transmission Assets') are in green.

15. **Chapter 5 Project Description** of the Environmental Statement (ES) (Document Reference 5.1.5) describes the key components and activities of the Project during the pre-construction, construction, operation and maintenance, and decommissioning phases. The key components of the Project, to be located entirely offshore within the windfarm site, comprise:

- Wind turbines generators (WTGs)
- Offshore substation platform(s) (OSP(s))
- Subsea cables (inter-array cables connecting the WTGs and OSPs, and platform link cables connecting OSPs)

16. The detailed design of these components will be determined post-consent such that the latest technology, most up-to-date regulations and the most cost-effective solutions can be considered and employed at that later stage to achieve good design.

17. Given that specific design details are not yet defined, a Project Design Envelope Approach (PDE Approach) has been adopted in the Project ES to determine maximum and minimum design parameters (design envelope) of the Project. This PDE Approach is usually adopted for offshore windfarm projects and has been recognised as being consistent with planning law[4] and by the Nationally Significant Infrastructure Projects (NSIP) (PINS) Advice Note Nine: Rochdale Envelope (V3, 2018).

18. The PDE Approach allows realistic worst-case scenarios to be identified and assessed in the ES for each potential impact, based on the maximum parameters which the Project could be built out under the proposed consent. This maintains design flexibility and ensures that, provided the final design remains within the design envelope, its environmental effects have been fully assessed and the impacts will be no worse than those considered in the decision-making process. Please see **Chapter 6 EIA Methodology** of the ES (Document Reference 5.1.6) for further details and **Chapter 5 Project Description** (Document Reference 5.1.5) for the full range of PDE parameters of the Project.

[4] The approach is also known as the Rochdale envelope approach set out by the judgement in R v Rochdale MBC Ex p. Tew [2000] Env.L.R.1 which established that while it is not necessary or possible in every case to specify the precise details of development, the information contained in the ES should be sufficient to fully assess the project's impact on the environment and establish clearly defined worst case parameters for the assessment.

1.5 Other development projects

19. Within 50km of the Project, five other offshore wind projects are either consented or planned. The locations of these projects are shown in **Figure 5.2** of **Chapter 5 Project Description** (Document Reference 5.3.5) and **Plate 3**.

20. The first two out of these five projects are related to the Project, due to the proposed separate DCO application being made in relation to the Transmission Assets associated with the Project and the Morgan Offshore Wind Project:

- Morgan and Morecambe Offshore Wind Farms: Transmission Assets
- Morgan Offshore Wind Project: Generation Assets
- Mona Offshore Wind Project
- Mooir Vannin Offshore Wind Farm
- Awel y Môr Offshore Wind Farm

21. The Morgan Offshore Wind Project Generation Assets is commercially and financially distinct from the Project. The Morgan Offshore Wind Project Generation Assets is being developed by Morgan Offshore Wind Limited, a joint venture between bp Alternative Energy Investments Ltd. (bp) and Energie Baden-Württemberg AG (EnBW). At 37km from the coast of northwest England, and 22km from the Isle of Man, the Morgan windfarm site is further offshore than the Applicant's Project and extends up to the UK's jurisdictional boundary with the Isle of Man. Morgan Offshore Wind Project Generation Assets has a nominal capacity of 1.5GW and a DCO Application for the project was received by the Planning Inspectorate (PINS) on 24th April 2024, and accepted for examination on 17th May 2024.

22. Morgan and Morecambe Offshore Wind Farms: Transmission Assets refer to both the offshore and onshore assets for transmitting electricity generated from the Applicant's Project and the Morgan Offshore Wind Project: Generation Assets to the National Grid connection point. **Plate 2** illustrates the schematic components of the Project in blue and the components for the Transmission Assets in green. The Transmission Assets are planned to include shared offshore and onshore cable corridors (containing separate cables for both projects) connecting to onshore substations for each project, with subsequent onward cable connection to the National Grid at Penwortham, Lancashire. A separate joint DCO Application for the Transmission Assets is planned to be made in 2024 by the Applicant and the Applicant of the Morgan Offshore Wind Project (Morgan Offshore Wind Limited).

23. Mona Offshore Wind Project is another OWF being developed by bp and EnBW in the Irish Sea. Mona is situated entirely in Welsh waters, 28km from

the North Wales coastline, 46km from the northwest coast of England and 46km from the Isle of Man. Mona Offshore Wind Project has a nominal capacity of 1.5GW and includes a landfall point near Llanddulas, Conwy, on the North Wales coastline, and a point of connection to the existing Bodelwyddan National Grid substation in Denbighshire. PINS received a DCO Application for the Mona Offshore Wind Project on 22nd February 2024 and accepted it for examination on 21st March 2024.

24. Further afield is the proposed Mooir Vannin Offshore Wind Farm. This Project is proposed by Mooir Vannin Offshore Wind Farm Limited, which is ultimately owned by Ørsted A/S and has a planned generating capacity of up to 1.4GW. Mooir Vannin is the first OWF planned within the Isle of Man's territorial waters, between 6 and 12nm off the eastern coast of the Island. An application for consent to build the Mooir Vannin OWF is expected to be submitted for determination by authorities on the Isle of Man in 2025.

25. Awel y Môr OWF is located 10.5km off the Welsh Coast, in the Irish Sea, and to the west of the existing Gwynt y Môr OWF. It secured Approval of its DCO from the Secretary of State (SoS) for the Department for Energy Security and Net Zero (DESNZ) and Marine Licences from Natural Resources Wales (NRW) in 2023. It will become Wales' largest renewable energy project when operational, generating an anticipated capacity of up to 1.1GW, depending on final design parameters.

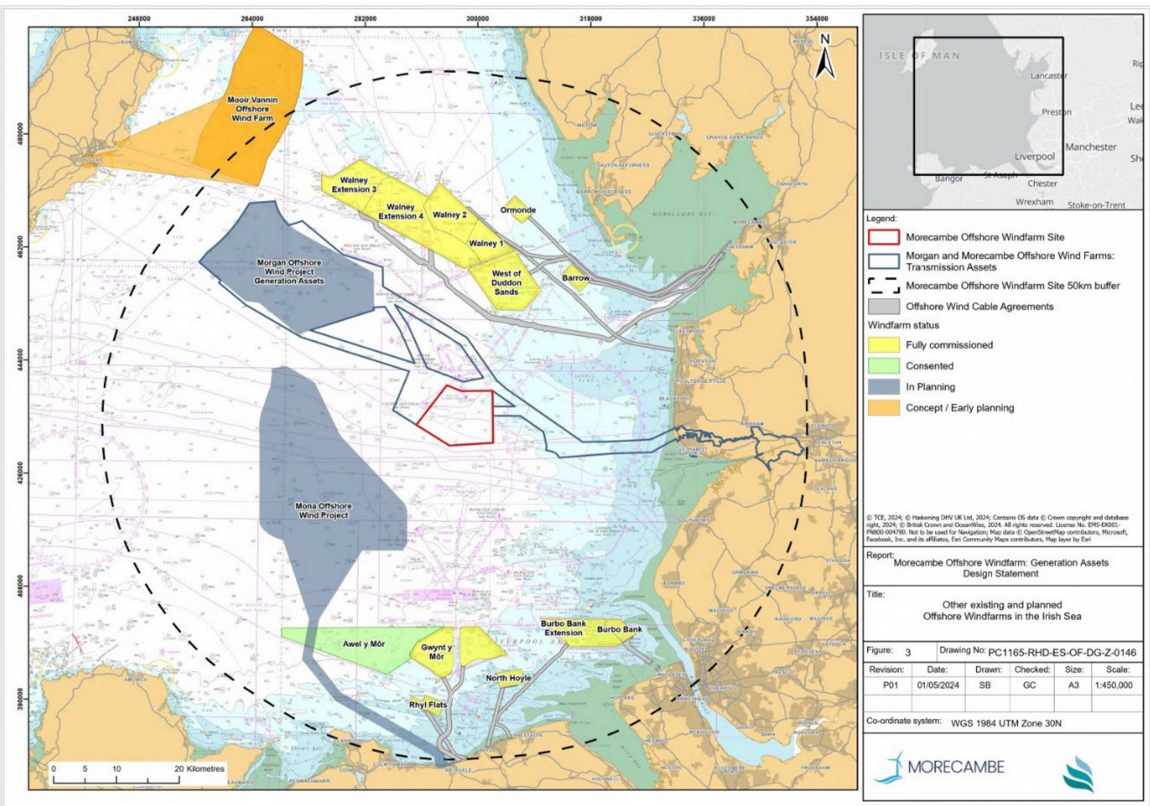

Plate 3 Other existing and planned offshore windfarms in the Irish Sea

2 Site context

2.1 The Irish Sea

26. The Irish Sea has numerous existing infrastructure and activities. Existing infrastructure and activities include shipping routes, operational offshore windfarms (OWFs), oil and gas operations, aggregate and disposal sites and existing subsea cable infrastructure. A key objective of the Project is to coordinate and coexist with other activities, developers and operators to use previously developed seabed (**Section 4.2**). Further information on the existing infrastructure and activities in the Project area is set out in **Chapter 17 Infrastructure and Other Users** (Document Reference 5.1.17).

27. Regular passenger ferry and cargo services cross the Irish Sea between Heysham, Liverpool and Belfast, Douglas, and Dublin.

2.1.1 Offshore wind

28. On a strategic level, established OWFs are closer to the coastline whereas newer and proposed OWFs are typically further offshore. Existing operational OWFs are located to the north and south of the Project windfarm site. West Duddon Sands and Walney 1 to 4 OWFs (including extensions) are between approximately 12km and to 20km north of the site respectively. Beyond West Duddon Sands OWF are Barrow and Ormonde OWFs, which are closer to the coastline of Barrow-In-Furness. The location of other windfarms is shown in **Plate 3**.

29. Approximately 30-40km to the south of the windfarm site, and beyond the coastline of Wales, are the operational Burbo Bank, Burbo Bank Extension, North Hoyle, Gwynt y Môr and Rhyl Flats OWFs. Other proposed OWF projects within the Irish Sea are discussed in **Section 1.5**.

2.1.2 Oil and gas

30. The Irish Sea has history of development of oil and gas reserves, with hydrocarbon licence blocks located to the north and south of the Project windfarm site. Two gas fields overlap with the windfarm site (the South Morecambe Gas Field and the Calder Gas Field). Both gas fields have been operating since the 1980's with associated platform, pipeline and cable infrastructure located within the vicinity of the windfarm site. The locations of hydrocarbon licence blocks and oil and gas infrastructure in the Irish Sea are shown in **Plate 4**.

31. Carbon capture and storage licence areas are also located within the Irish Sea, with the East Irish Sea Area 1 located to the north and overlapping with the windfarm site (**Plate 4**).

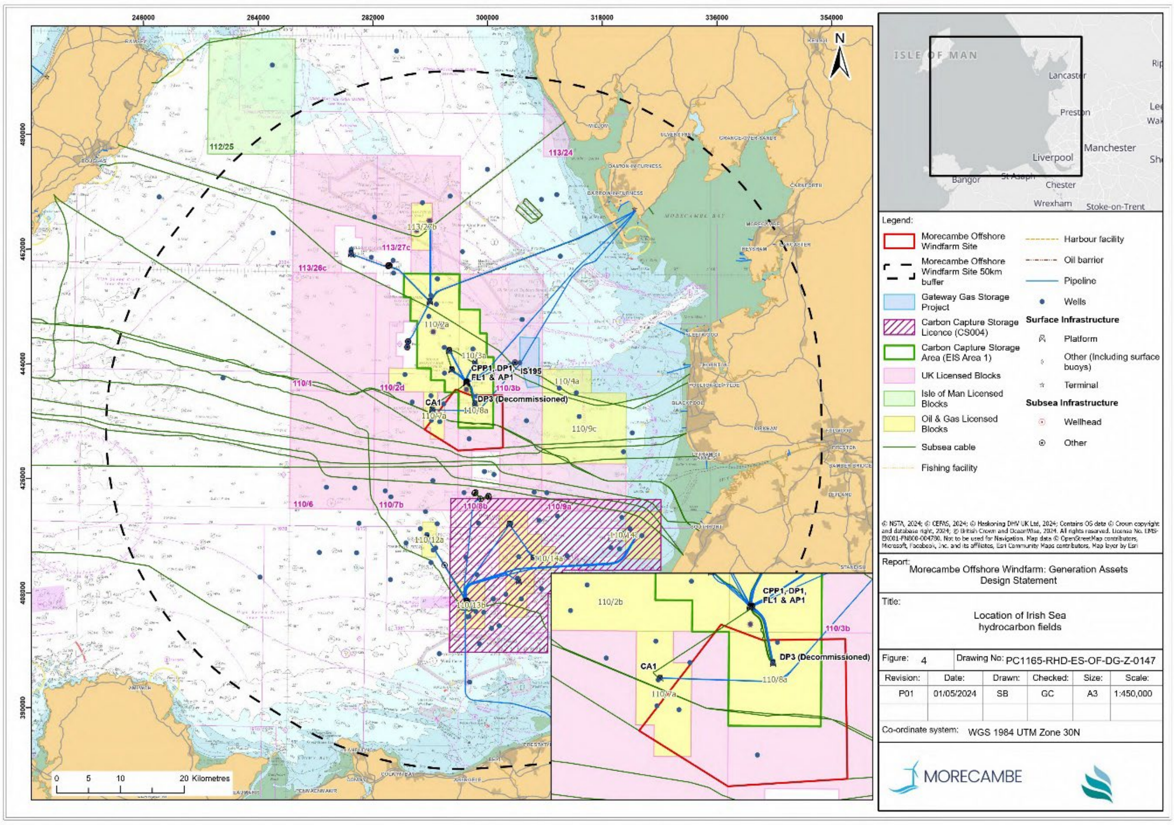

Plate 4 Locations of Irish Sea hydrocarbon licence blocks

2.1.3 Subsea cables

32. Several subsea cables cross the Irish Sea, linking mainland UK with the Republic of Ireland, Northern Ireland and the Isle of Man. Power cables also exist between offshore oil and gas facilities and linking offshore wind projects to the UK. Interconnector cables provide electrical supply between mainland UK and the Isle of Man and Ireland. Future cable and interconnector projects could be developed in the Irish Sea in the future. The locations of subsea cables and interconnectors are shown in **Plate 5.**

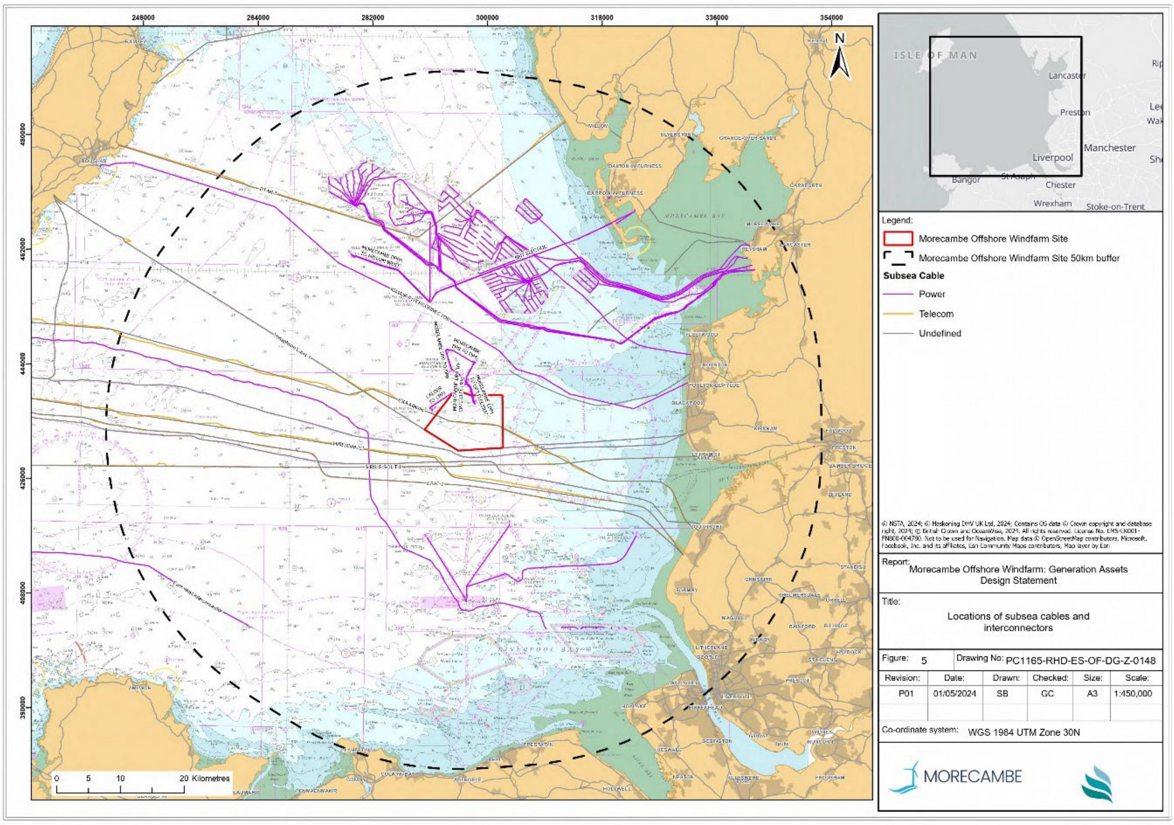

Plate 5 Locations of Irish Sea subsea cables and interconnectors

2.2 Site overview

33. The Project windfarm site covers an area of approximately 87km^2. The Project proposes to maximise the use of previously developed seabed given parts of the seabed have been leased to other operators and natural resources have been explored in the past.

34. As noted in **Section 2.1.2** and **Plate 4** the windfarm site overlaps with the existing South Morecambe Gas Field and the Calder Gas Field and is in proximity to existing infrastructure of platforms, pipelines, cables and wells of these fields. The South Morecambe DP3 platform (charted within the windfarm site) has been decommissioned and was fully removed in 2023. The Calder platform (CA1) is located 0.9km to the west of the Project windfarm site and the South Morecambe Central Processing Complex (CPC) is located 1.5km to the north.

35. An operational gas pipeline runs through the northern part of the windfarm site to connect the Calder platform to shore, whilst the telecommunication cable EXA Atlantic (formerly GTT Hibernia Atlantic) traverses the windfarm site in an east to west direction. The Lanis 1 cable, owned by Vodafone, runs along the southern edge of the windfarm site, defining the southern boundary.

2.3 Bathymetry and geology

36. Water depths within the site range from 18m below the Lowest Astronomical Tide (LAT) in the eastern part of the windfarm site to 40m below LAT in the south-west of the windfarm site. The seabed gradient across the site is very gentle, with slopes of less than 1° across most of the site. The water depth of the Irish Sea is shown in **Plate 6**.

37. The Irish Sea, over its history, has experienced periods of glaciation, resulting in a complex geology. There are five geological units (volumes of rock of known origin and age, based on the geological timescale) beneath the windfarm site, dating from the Pleistocene epoch (circa 2.6 million to 11,700 years ago). The thickness of these geological units is not uniform across the site.

38. The predominant surface sediment is sand in the northeast and southwest of the site, with clayey sand in the centre and gravelly sand to the east of the site.

39. Further detailed analysis of the existing environment is in **Chapter 7 Marine Geology, Oceanography and Physical Processes** (Document Reference 5.1.7).

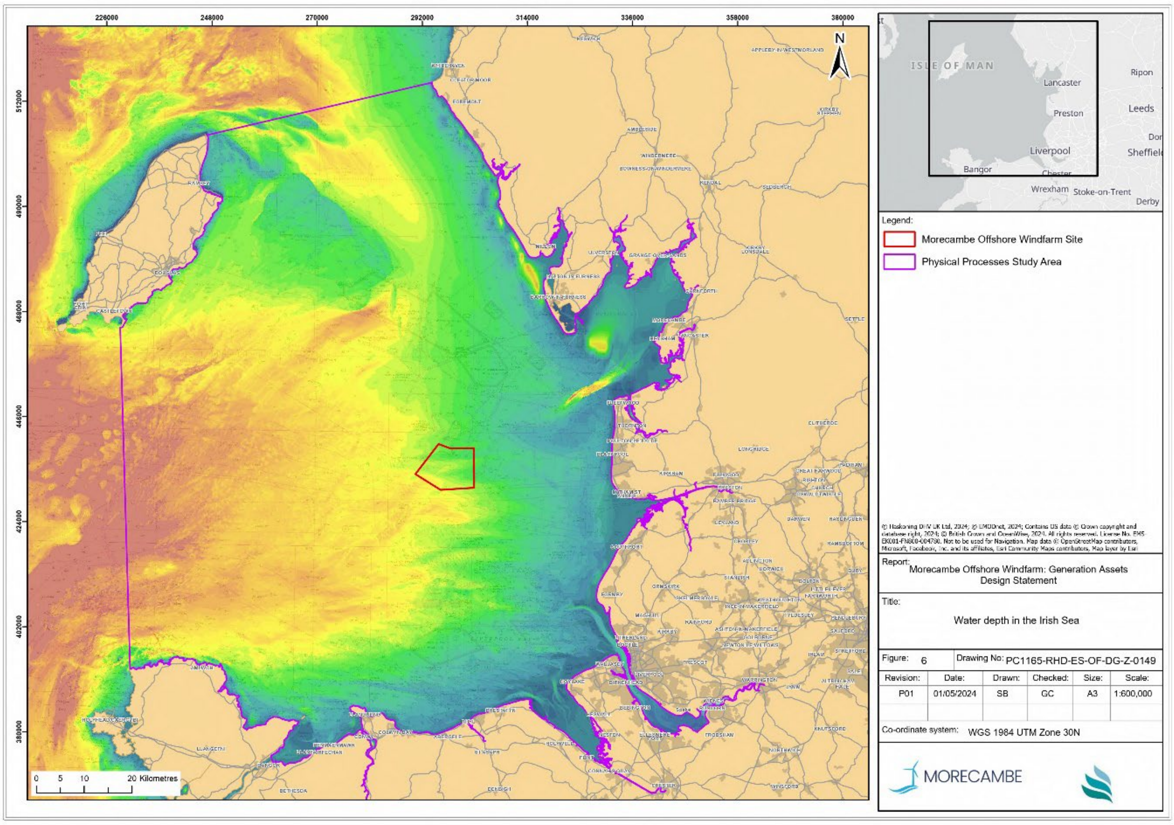

Plate 6 Water depths in the Irish Sea

2.4 Seascape and landscape

40. The Project is located primarily within the expansive waters of the Marine Character Area (MCA(2)) 38 Irish Sea South. This part of the Irish Sea is a busy seascape, with multiple offshore activities including commercial fishing, main shipping routes, oil and gas extraction, dredging and numerous and extensive operational offshore windfarms.

41. The MCAs(2) in the study area are shown in **Figure 18.9** of **Chapter 18 Seascape, Landscape and Visual Impact Assessment** (Document Reference 5.1.18) and include:

- MCA(2)32 Walney Coastal Waters and Duddon Estuary – The windfarm site lies outside of MCA(2)32
- MCA(2)34 Blackpool Coastal Waters and Ribble Estuary – The northeastern part of the windfarm site lies within MCA(2)34
- MCA(2)38 Irish Sea South – The majority of the windfarm site lies within MCA(2)38

42. When viewed from the coastline in the study area, many views of the Project are either distant or heavily influenced by the baseline influence of existing OWFs located to the north and south of the windfarm site.

43. Significant visual effects identified would be contained within the areas of the Fylde and Sefton coasts, where people have a high sensitivity to changes in

the sea views, which are considered to be a fundamental part of the appeal of the coast and settlements at Blackpool, Lytham St Anne's and Southport. Although there would be localised significant effects on views from this section of coast, these visual effects would not result in significant effects on the perceived landscape character, which is extensively urbanised, and its urban/settled character would not be changed as a result of the Project.

44. Arnside & Silverdale and Forest of Bowland National Landscapes are located more than 50km away from the windfarm site. The effect of the Project on these National Landscapes would not be significant due to the separation distance and low frequency of visibility at such long range.

45. Further detailed analysis of the existing environment is in **Chapter 18 Seascape, Landscape and Visual Impact Assessment** (Document Reference 5.1.18).

2.5 Marine ecology and ornithology

46. The Project lies outside any environmentally designated sites (**Plate 7**) and borders with the Liverpool Bay SPA along the Project's eastern boundary.

47. The seabed across the windfarm site is dominated by sands. The corresponding benthic communities are typical of these sandy sediment habitats in the wider Irish Sea area.

48. Fish and shellfish receptors in the Project study area include spawning grounds, nursery grounds, pelagic fish, demersal fish, diadromous fish, elasmobranchs, molluscs, crustaceans and designated sites. The windfarm site is generally unsuitable for sandeel and herring spawning, with the nearest herring spawning grounds located approximately 40km northwest of the Project. Potential species of conservation importance include ray and shark species, including basking shark and migratory fish species such as Atlantic salmon, sea trout, smelt and European eel.

49. The windfarm site and surrounding buffer area was surveyed using high resolution digital aerial surveys over a period of 24 months to identify levels of marine mammals and seabird species present.

50. Marine mammal species present in the area include harbour porpoise, bottlenose dolphin, common dolphin, Risso's dolphin, white-beaked dolphin, minke whale, grey seal and harbour seal.

51. Twenty-two seabird species were recorded and key species included common scoter, gannet, guillemot, razorbill, kittiwake, lesser black-backed gull, Manx shearwater, red-throated diver and Sandwich tern. The windfarm site is located outside of areas known to support high concentrations of seabirds, and there are a limited number of large seabird colonies for key

species within the respective mean maximum foraging ranges of the Project.

52. Further detailed analysis of the existing environment is in **Chapter 9 Benthic Ecology** (Document Reference 5.1.9), **Chapter 10 Fish and Shellfish** (Document Reference 5.1.10), **Chapter 11 Marine Mammals** (Document Reference 5.1.11) and **Chapter 12 Offshore Ornithology** (Document Reference 5.1.12) and **Appendix 12.2 Aerial Survey Two Year Report March 2021 to February 2023** (Document Reference 5.2.12.2). Marine Conservation designations are shown in **Plate 7**.

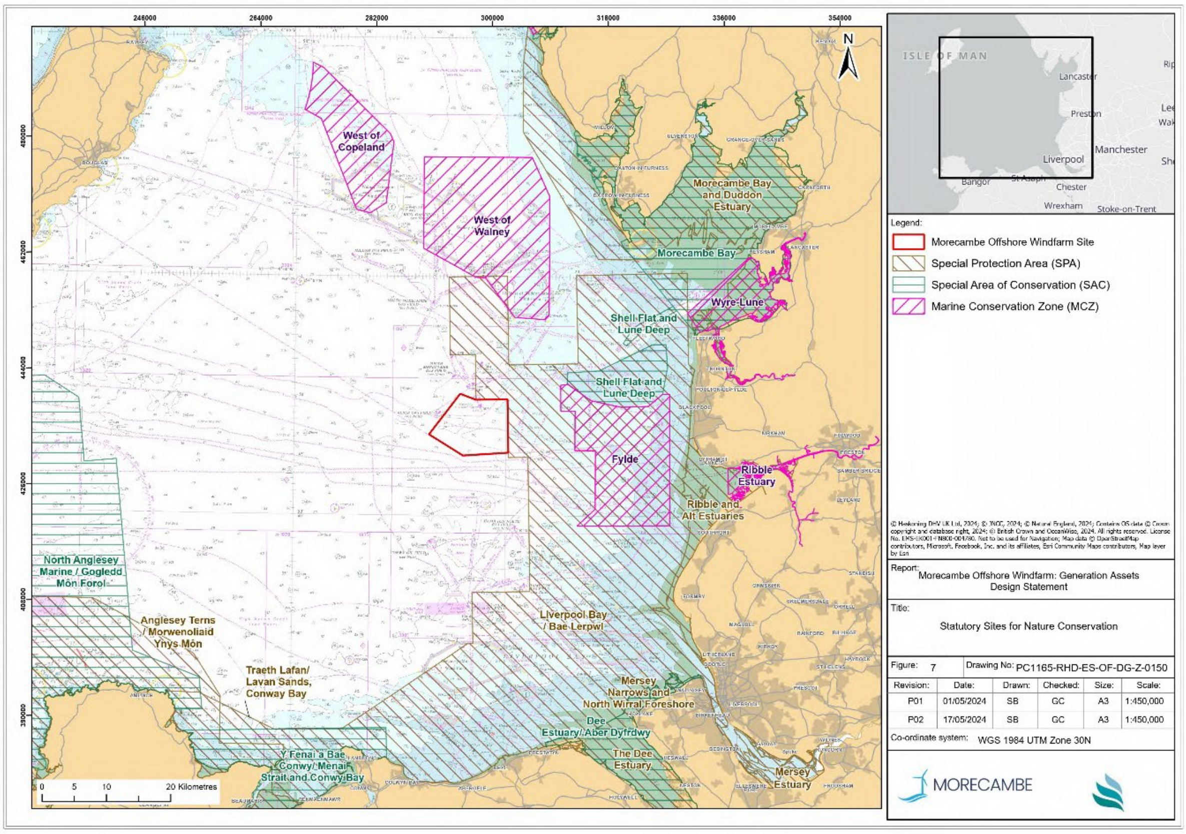

Plate 7 Statutory Sites for Nature Conservation

2.6 Historic environment

53. Within the Project windfarm site there are no heritage assets subject to statutory protection and no known submerged prehistoric sites.

54. There is some potential for palaeoenvironmental and prehistoric archaeological remains associated with deltaic sediments laid down after the Last Glacial Maximum and with channel features cut into the underlying glaciomarine/marine sediments and till. This potential is likely to have been reduced due to the effects of marine erosion during the Holocene transgression.

55. Geophysical survey has been conducted across the Project windfarm site and analysed. There are no known wrecks within the windfarm site and no geophysical anomalies of high potential to be of archaeological significance. Four medium potential anomalies within the windfarm site have been assigned Archaeological Exclusion Zones (AEZs). These are of anthropogenic origin and would require further investigation to establish their archaeological significance.

56. Seventeen low potential anomalies within the site (potentially of anthropogenic origin but unlikely to be of archaeological significance) would be avoided by means of micrositing during detailed project design, where possible.

57. Forty-five magnetic anomalies (items of metallic debris of uncertain archaeological interest) were also identified within the windfarm site, one of which has been assigned a Temporary Exclusion Zone (TEZ) due to its large size and greater potential to be of archaeological interest.

58. UK Hydrographic Office (UKHO) and Historic England (HE) maritime records within the windfarm site comprise only 'fishermen's' fasteners' (places where fishermen have snagged their fishing gear). Nothing has been seen at these recorded locations in the collected geophysical data.

59. Further detailed analysis of the existing environment is in **Chapter 15 Marine Archaeology and Cultural Heritage** (Document Reference 5.1.15) and on the **Historic Environment Plan** (Document Reference 2.7).

2.7 Shipping and navigation

60. There are no internationally recognised sea lanes, including International Maritime Organisation (IMO) routeing/reporting measures or recommended channels in the Project windfarm site, the closest being the Liverpool Traffic Separation Scheme (TSS) 12.4nm to the south of the site.

61. The closest port/harbour is the Port of Barrow approximately 19nm northeast of the windfarm site.

62. Service vessels associated with existing OWFs and oil and gas infrastructure account for a large proportion of vessel movements within the Project study area.

63. Other vessels passing within the vicinity of the Project windfarm site are predominantly ferries and commercial cargo, with some passing through or adjacent to the site.

64. The Stena Line east of Isle of Man (east of Calder) route between Liverpool and Belfast passes northwest/southeast through the centre of the Project windfarm site. Both the Isle of Man Steam Packet Company (IoMSPC) route between Liverpool and Douglas and the Stena Line east of Isle of Man (west

of Calder) route between Liverpool and Belfast pass to the southwestern corner of the windfarm site. Other ferry routes transit outside the Project windfarm site (**Plate 8**). Analysis of adverse weather routeing shows that passenger vessels typically deviate from their usual routes to west of the study area.

65. Fishing activity occurs across the study area throughout the year, with the windfarm site predominantly used by vessels using static gear. The key fleets considered in the ES assessment were identified as the UK (and Isle of Man) and Irish scallop dredgers; UK (and Isle of Man) potters targeting shellfish (primarily whelk offshore, but also lobster and brown crab); UK and Belgian beam trawlers targeting sole, plaice and other demersal fish (fish species that live close to the sea bed), with localised inshore trawling targeting brown shrimp and UK inshore vessels under 10m in length targeting a variety of demersal species (e.g. bass) using nets and hooked gear.

66. Recreational vessels remain predominately along the coast, distant from the Project site, particularly along the entrance to Liverpool, and around Holyhead Douglas and Rhyl.

67. There are no military practice and exercise areas (PEXAs) or highly surveyed routes within the Project windfarm site.

68. Further detailed analysis of the existing environment is in **Chapter 14 Shipping and Navigation** (Document Reference 5.1.14).

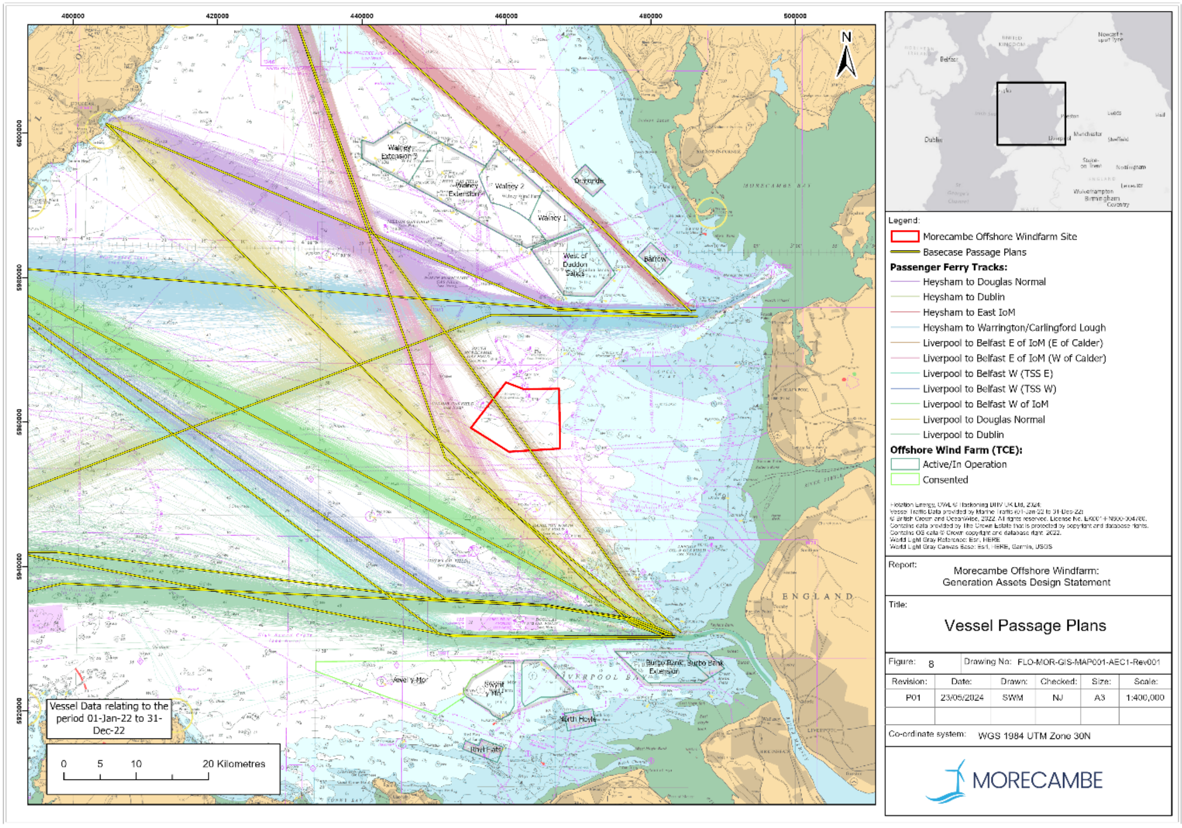

Plate 8 Typical ferry passage in Eastern Irish Sea

3 Good design policy context

69. Government policy to secure good design for national infrastructure is embedded in National Policy Statements (NPS), Marine Plans (MP) and in the National Infrastructure Commission's (NIC) Design Principles for National Infrastructure. The key design policies from these documents are summarised in this section.

70. NPS EN-1 sets out policies for considering and assessing good design in a DCO application.

71. The North West MP places emphasis on a proposal's impacts on landscapes and seascapes, as well as on interactions with other marine uses.

72. The Design Principles for National Infrastructure focus on setting a framework for design, the process of design and considering design in all stages of a project.

73. Design policies in all these documents are complementary in promoting good design and are covered below.

3.1 National policy statements

74. NPSs are a suite of documents that must be considered when deciding on NSIPs.

75. Section 4.7 of the Overarching NPS for Energy (EN-1) sets out generic principles of good design in a DCO application. NPS for Renewable Energy (EN-3) sets out specific design policies for offshore windfarms.

Table 3.1 NPS Policy on Good Design

NPS	Relevant Text	Where is this addressed
EN-1 4.7.1	*"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. The functionality of an object – be it a building"*	4.3 Design Principles & 6.2 Design Code
EN-1 4.7.5	*"a project board level design champion could be appointed, and a representative design panel used to maximise the value provided by the infrastructure."*	6.1 Post-consent design process and governance
EN-1 4.7.5	*"Design principles should be established from the outset of the project to guide the development from conception to operation"*	4.3 Design Principles

NPS	Relevant Text	Where is this addressed
EN-1 4.7.5	"*Applicants should consider how their design principles can be applied post-consent*"	6.1 Post-consent design process and governance
EN-1 4.7.7	"*Applicants must demonstrate in their application documents how the design process was conducted and how the proposed design evolved.*"	5. Design approach and evolution
EN-1 4.7.10	"*In the light of the above and given the importance which the Planning Act 2008 places on good design and sustainability, the Secretary of State needs 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."	4.3 Design Principles & 6.2 Design Code
EN-1 4.7.11	"*In doing so, the Secretary of State needs to be satisfied that the applicant has considered 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, any potential amenity benefits, and visual impacts on the landscape or seascape) as far as possible.*"	4.3 Design Principles & 6.2 Design Code
EN-1 4.7.12	"*In considering applications, the Secretary of State should take into account the ultimate purpose of the infrastructure and bear in mind the operational, safety and security requirements which the design has to satisfy. Many of the wider impacts of a development, such as landscape and environmental impacts, will be important factors in the design process.*"	4.3 Design Principles & 6.2 Design Code
EN-3 2.3.5	"*In general, the government does not seek to direct applicants to particular sites for renewable energy infrastructure. In specific circumstances it may be appropriate to provide some direction or guidance, for example to areas of search or areas to avoid through Marine Plans, Strategic Environmental Assessments (SEAs) or The Crown Estate Leasing Rounds, in respect of marine renewable technology.*"	5. Design approach and evolution
EN-3 2.8.13	"*The specific criteria considered by applicants, and the role that they play in site selection, will vary from project to project*"	5. Design approach and evolution
EN-3 2.8.25	"*Individual project lease agreements from The Crown Estate often include limits on*	4.3 Design Principles & 6.2 Design Code

NPS	Relevant Text	Where is this addressed
	development (such as a maximum generation capacity), which are used by The Crown Estate as a proxy to establish environmental effects at the plan level. Consistent with the Government's objectives in this NPS, project developers should seek to maximise their capacity within the technological, environmental, and other constraints of the project…."	
EN-3 2.8.31	"*Water depth, bathymetry and geological conditions are all important considerations for the selection of sites and will affect the design of the foundations of the turbines, the layout of turbines within the site and the siting of the cables that will export the electricity.*"	5. Design approach and evolution

3.2 North West Marine Plan Policy

76. The UK Government's Policy NW-SCP-1 expects proposals to be compatible with their surroundings and not have a significant adverse impact on the seascapes and landscapes of an area. Significant adverse impact should be dealt with in order of preference: avoid, minimise, mitigate and if it is not possible to mitigate, the public benefits for proceeding with the proposal must outweigh significantly. The Project's compliance with the MP is demonstrated in the **Marine Plan Policy Review** (Document Reference 4.7).

3.3 Design Principles for National Infrastructure

77. The National Infrastructure Commission (NIC) has published Design Principles for National Infrastructure. The NIC believes that large scale infrastructure should be well designed because these "*Projects shape the landscape for decades, even centuries*" (page 4) and because "*Infrastructure can and should be a source of pride*" (page 4).

78. This document states that design is a process, which should involve every person on the project and be embedded at every stage of its planning and delivery.

79. There are four NIC design principles for national infrastructure. The principles advocate everyone being involved by appreciating the wider context, engaging meaningfully and continuous measuring and improvement when applying all four principles.

- **Climate**: mitigate Greenhouse Gas (GHG) emissions and adapt to climate change
- **People**: reflect what society wants and share benefits widely

- **Places:** provide a sense of identity and improve our environment
- **Values:** achieve benefits and solve problems well

3.4 MGN654 Offshore Renewable Energy Installations (OREI) – Guidance on UK Navigational Practice, Safety and Emergency Response

80. The Maritime and Coastguard Agency (MCA(1)) is a statutory consultee for the Project's DCO application. Its Marine Guidance Note (MGN654) provides guidelines on safeguarding navigational safety, emergency response and Search and Rescue (SAR). These guidelines, whilst intended for navigation, have implications for the practical layout of a windfarm.

81. Paragraph 6.2b of MGN654 states that multiple lines of orientation in straight rows and columns yield the safest arrangement, with particular regard to (SAR) considerations, "*Multiple lines of orientation provide alternative options for passage planning and for vessels and aircraft to counter the environmental effects on manoeuvring i.e. sea state, tides, currents, weather, and visibility. OREI structures (turbines, substations, platforms, and any other structure within the OREI site) that are aligned in straight rows and columns are considered the safest layout arrangement by UK navigation stakeholders and the MCA(1) contracted SAR helicopter pilots*".

82. Paragraph 6.2c of MGN654 objects to a single line of orientation without suitable justification and deems zero lines of orientation unacceptable in any case, *"The MCA(1) will not consider any layout proposals with just one line of orientation, without supporting documentation which fully justifies the proposed layout to the satisfaction of the MCA(1). A layout with zero lines of orientation will not be acceptable to the MCA(1)".*

83. And finally, paragraph 6.2h of MGN654 insists that vessels and helicopters maintain continuous passage when traversing multiple OREI sites, *"Where multiple OREI sites have adjacent boundaries less than 1nm apart, including extensions to existing sites, due consideration must be given to the requirement for lines of orientation that allow a continuous passage for vessels and/or SAR helicopters through both sites, whilst maintaining plans for at least two lines of orientation as appropriate to the site-specific nature of that site".*

84. The abovementioned guidance must be followed when designing a layout for a windfarm site and is therefore incorporated as part of the Project Design Code below.

4 Design framework

4.1 The Applicant's vision for the Project

85. The Applicant has developed the following initial vision for the Project:

"Renewable energy is central to supporting the UK's ambitions to lead the world in combatting climate change, reducing our reliance on fossil fuels and embracing a future where renewable energy powers our homes and businesses.

Morecambe Offshore Windfarm has a nominal capacity of 480MW - enough to power over half a million households. It will also contribute to the UK Government's commitment to:

- *Generate 50GW of power from offshore wind by 2030*
- *Reach net zero by 2050.*

4.2 Project objectives

86. The Project's objectives have been defined as follows:

1. **Decarbonisation:** Generate around 480MW of low carbon electricity from an offshore windfarm, in support of the Net-Zero by 2050 target and UK Government ambition to deliver 50GW of offshore wind by 2030
2. **Security of supply:** Provide significant electricity generation capacity within the UK to support commitments for offshore wind generation and security of supply
3. **Affordability:** Maximise generation capacity at low cost to the consumer from viable, developable seabed within the constraints of available sites and grid infrastructure
4. **Coordination:** Coordinate and coexist with other activities, developers and operators to use previously developed seabed to deliver the Project and its skills, employment and investment benefits in the Local Economic Area.

4.3 Design Principles

87. The Applicant has four Design Principles for the Project. **Table 4.1** cross references the Design Principles for the Project with those in the Design Principles for National Infrastructure.

Table 4.1 Design Principles for the Project

National Infrastructure Commission Design Principle	Project Design Principle	Background
People	**Excellence in Safety**: a design which always respects the safety of people, communities and the environment, which meets UK statutory and regulatory requirements and current HSEQ (Health, Safety, Environment and Quality) and site environmental requirements	Both joint venture companies of the Applicant are founded on principles of safety and as part of the overall company missions. Section 4.13 of NPS EN-1 sets out the safety requirements applying to the Project and paragraph 4.7.12 acknowledges the safety and security requirements that projects must meet.
Value	**Functionality & Adaptability**: a design which recognises the advancing nature of technology and is efficient in its use of resources and energy generation throughout the life of the Project	Construction of offshore components and windfarms is inherently expensive and relies on the availability of a highly-skilled workforce, specialised equipment and vessels. Section 3.3 of NPS EN-1 requires the delivery of an affordable energy system.
Places	**Synergies & Reuse**: a design which through proactive and thorough coordination and collaboration with other users, maximises the use of previously developed seabed and the benefits of the Project	Since a key objective of the Project is to achieve synergies and re-use of previously developed seabed, its design will require close levels of cooperation and integration of marine uses in construction and operational phases. Section 2.8 of NPS EN-3 acknowledges the increasing demands for use of the marine area and requires higher levels of collaboration and coexistence in the siting and design of offshore windfarms in particular.
Climate	**Planet Positive**: a design which maximises renewable energy, is adapted for our changing climate, responds to its seascape and to views out to sea and where possible will enhance the environment and its biodiversity	Decarbonisation of the UK's energy supply features highly amongst the Project's objectives. Section 2 of NPS EN-1 sets out the climate change basis for NPS policy as a whole.

5 Design approach and evolution

5.1 Site selection and evolution

88. This section summarises the site selection process, including The Crown Estate (TCE) Leasing Round 4 process which identified the Agreement for Lease (AfL) area for the Project. In addition, the section describes the considerations made to inform a subsequent decision to refine the Project site boundary.

89. The criteria in the Round 4 bidding rules, which informed the site selection process, influenced the Applicant's decision to utilise previously developed seabed (reflected in the Project Objectives). Furthermore, the complexity of the seabed and needs of other marine users helped shape the Project site current boundary.

90. Further information on the site selection process is found in **Chapter 4 Site Selection and Assessment of Alternatives** (Document Reference 5.1.4).

91. TCE's Leasing Round 4 was supported by five objectives (TCE, 2019) that balanced the need for clean, reliable and low-cost power, whilst protecting the seas and the wider environment, such that any successful bid under it:

- "*Delivers a robust pipeline for low-cost offshore wind deployment*
- *Offers an attractive, accessible and fair proposition to developers*
- *Balances the range of interests in the marine environment*
- *Makes efficient use of the seabed*
- *Unlocks the commercial value of the seabed in line with The Crown Estate's statutory obligations*"

92. TCE initially identified 18 Regions around the England, Wales and Northern Ireland that could potentially be developed for offshore wind in their Leasing Round 4. These 18 Regions are shown in **Plate 9**.

93. The 18 potential Regions were reduced to four Bidding Areas (**Plate 10**) in September 2019. The Project is located in Bidding Area 4 – Northern Wales & Irish Sea (comprising the North Wales region, Irish Sea region and the Anglesey region).

94. The Applicant selected Bidding Area 4 as the preferred Bidding Area, because it offered unique opportunities to coexist with existing users on a site located within oil and gas fields near the end of productive life.

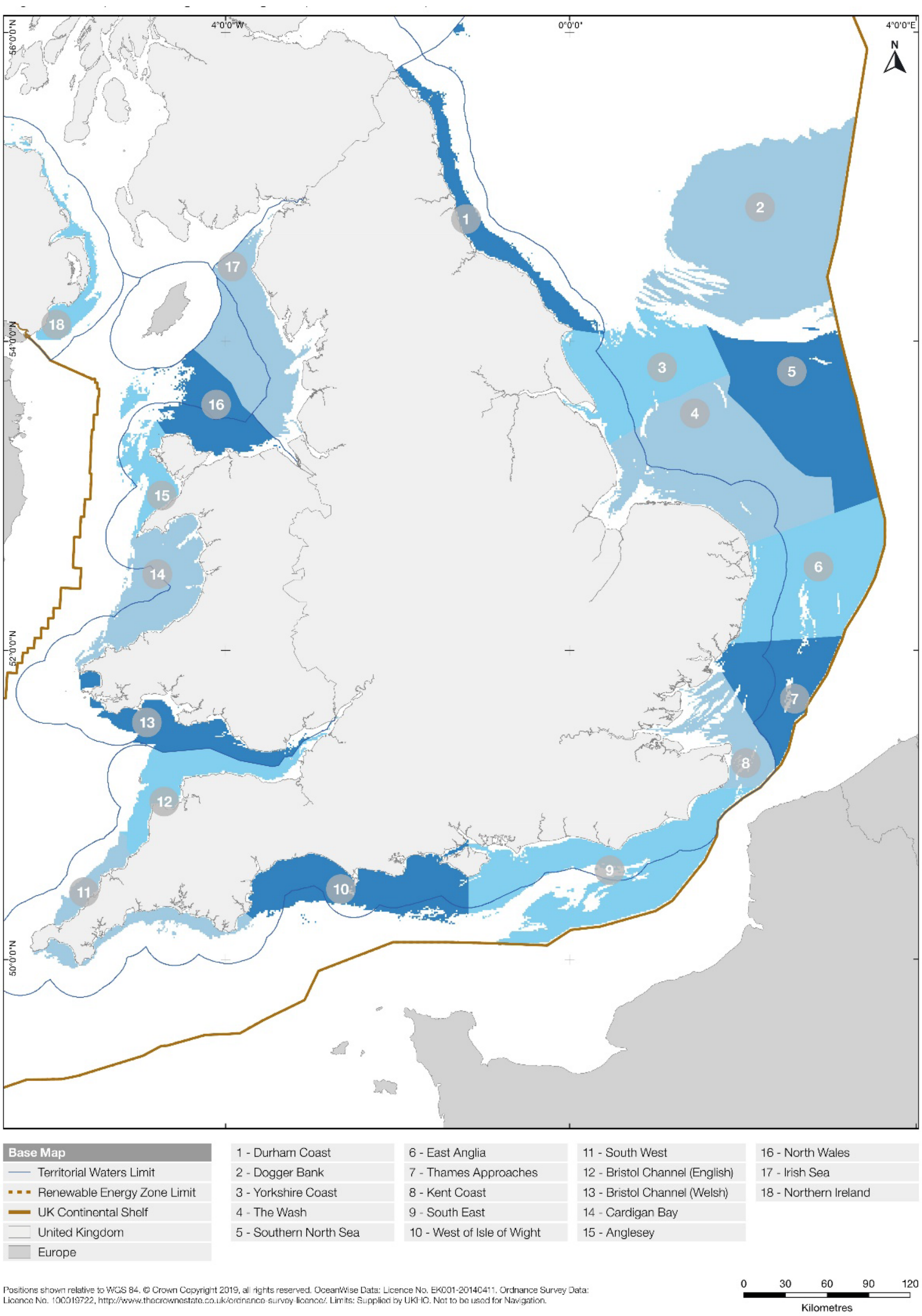

Plate 9 The 18 'characterisation areas' identified by TCE (November 2018)

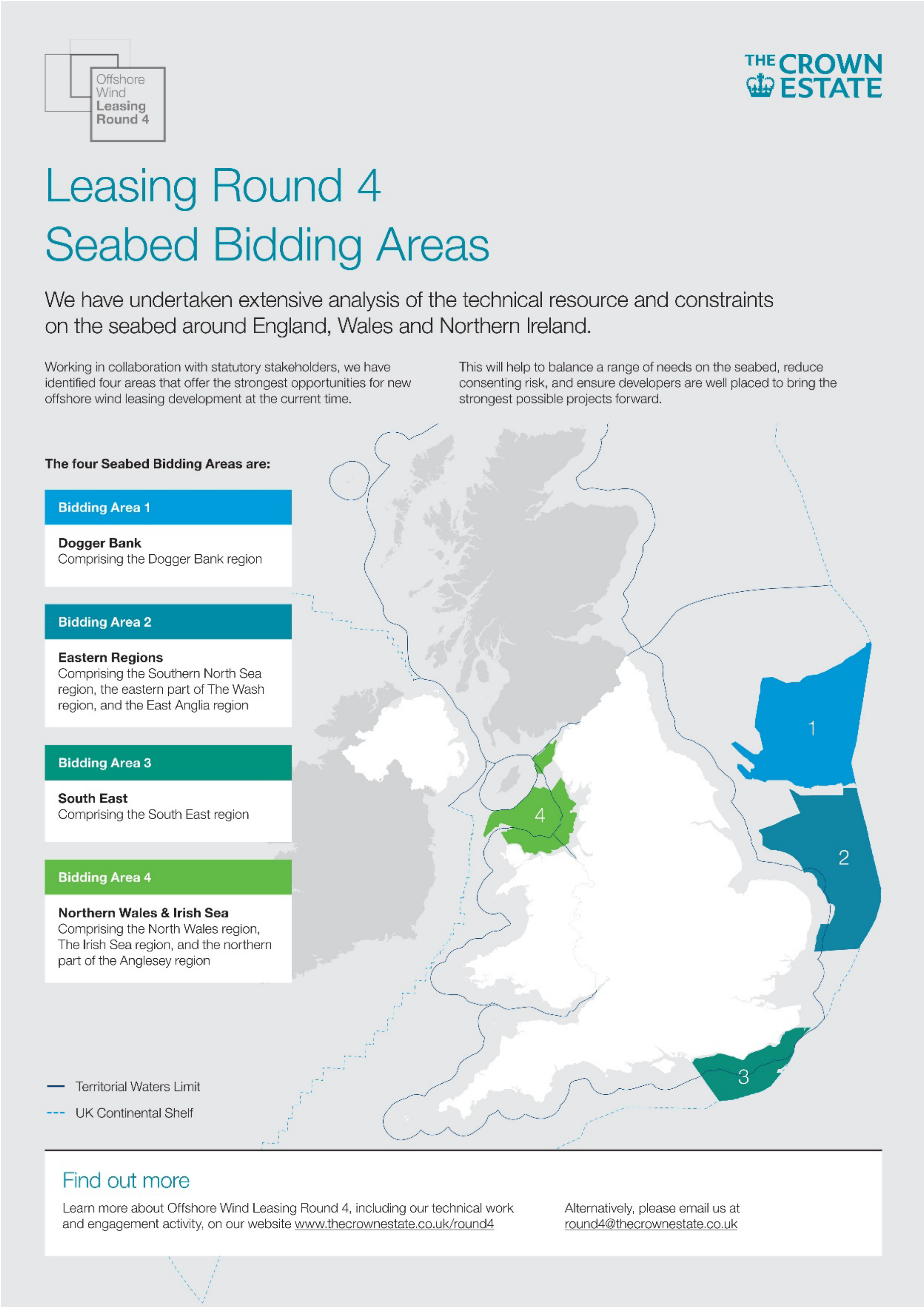

Plate 10 The final bidding areas identified by TCE (September 2019)

95. During the Round 4 bidding process a refined zone within the Bidding Area 4 that had a lower number of constraints and higher potential for co-existence opportunities was identified for further site selection analysis (the Morecambe Zone) (**Plate 11**). Subsequent to this analysis, the Applicant made a bid with a nominal capacity of 480MW in a location within the vicinity of existing oil and gas assets. This was a balanced decision on commercial

viability and technical feasibility, as well as minimising the disturbance to existing sea users and stakeholders and minimising use of undeveloped areas of the Irish Sea.

96. In line with the Leasing Round 4 bidding rules, and in the interests of good design, the Applicant avoided IMO Traffic Separation Schemes (TSS), existing offshore wind lease agreement areas, deep water channels, marine aggregate licence areas and dredging areas. In addition, the site would not overlap with disposal sites, PEXAs or environmentally designated sites, i.e. Liverpool Bay SPA.

97. The Applicant was selected by TCE as a preferred Round 4 bidder in 2021, and in January 2023, a Round 4 AfL was signed for the Project. The AfL area (125km^2) was assessed at the Preliminary Environmental Impact Report (PEIR) stage (**Plate 11**). Subsequent to the statutory consultation on the PEIR, the spatial extent of the windfarm site was reduced eastward, such that the windfarm site now occupies 87km^2. The reduced spatial extent ensures that there is a reduction in the apparent lateral spread of WTGs when viewed from the coast, particularly from the north and south. This refinement of the Project site to 87km^2 (as shown in **Plate 12**) was based on the following criteria:

- Provision of greater sea room between the boundaries of this Project, the Morgan Offshore Wind Project Generation Assets and the Mona Offshore Wind Project, in order to mitigate impacts to existing ferry and other shipping routes between Liverpool, the Isle of Man and Belfast
- Reduction in interaction with the gas field operations, including vessel and helicopter approaches to the Calder CA1 platform (which following the boundary change now sits outside the Project site) and a commitment (secured by protective provisions in the **draft DCO** (Document Reference 3.1)) that no WTGs or OSPs would be located within 1.5 nm of oil and gas platforms with active helidecks
- The exclusion of the area west of the Calder CA1 platform reduces the need for long inter-array cables, thus reducing disturbance to the seabed and helping to minimise installation cost and electrical losses
- Reduction in the presence of mega ripples and sandwaves, which can lead to a reduction in the level of sebed preparaton required
- Although the Applicant has not altered the eastern boundary, the Project site has not been extended closer to the coastline, in part to ensure no overlap with Liverpool Bay SPA, or increased visual impacts on local communities

98. The Project would comply with legal requirements with regards to shipping, navigation and aviation marking and lighting. Marking and lighting of the Project would be undertaken in accordance with relevant industry guidance and as advised by relevant stakeholders. This commitment ensures compliance with lighting and marking requirements but also sets the relevant

parameters for the SLVIA of the Project in relation to night-time effects assessment

99. Marine navigational lights would be fitted at the platform level on significant peripheral structures, synchronised to display IALA (International Association of Marine Aids to Navigation and Lighthouse Authorities) '*special mark'* characteristic, flashing yellow, with a range not less than 5nm. A lighting scheme would be agreed for the aviation lighting of structures (WTGs and OSP(s)) with relevant authorities. This commitment provides for minimising lighting impacts as far as practicable, whilst ensuring compliance with legal requirements for lighting and marking the Project. Aviation warning lights would have reduced intensity at and below the horizontal and allow a further reduction in lighting intensity when the visibility in all directions from every WTG is more than 5km. These measures will also reduce impacts on bird species.

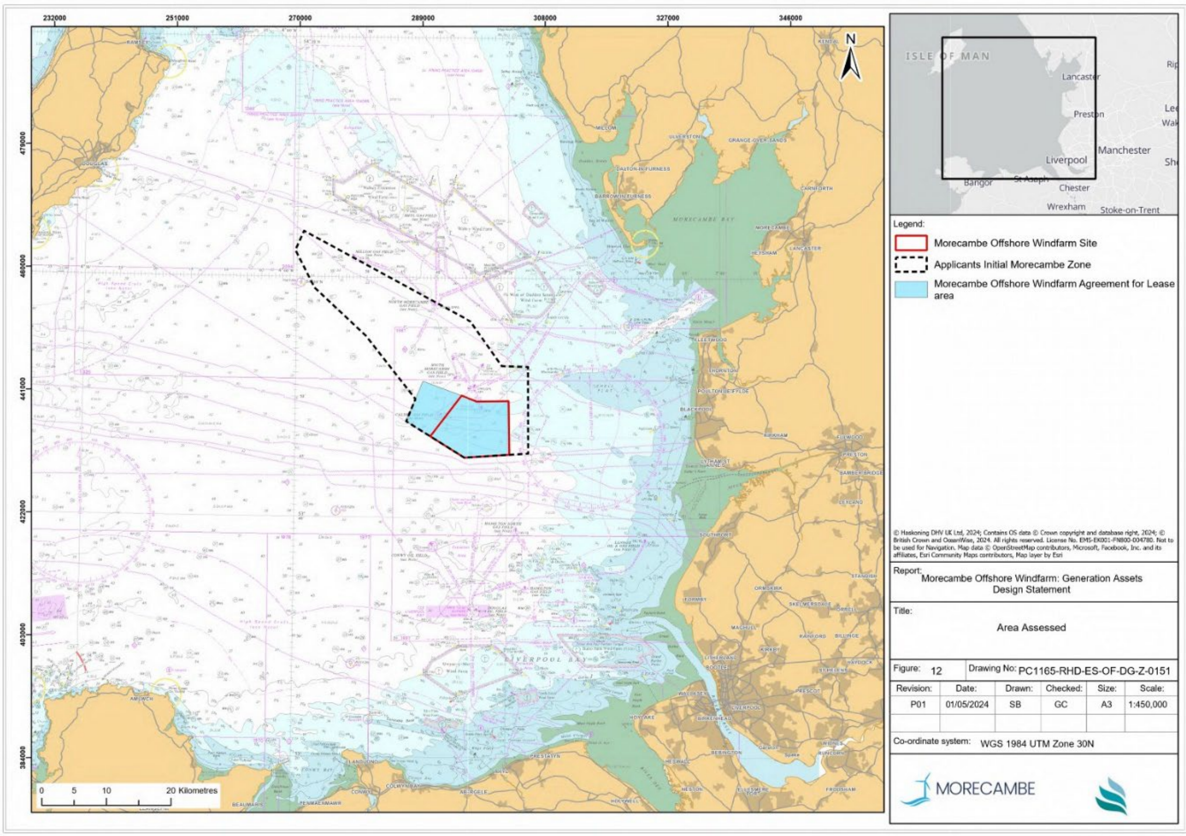

Plate 11 Windfarm AfL area assessed at PEIR stage (shaded blue)

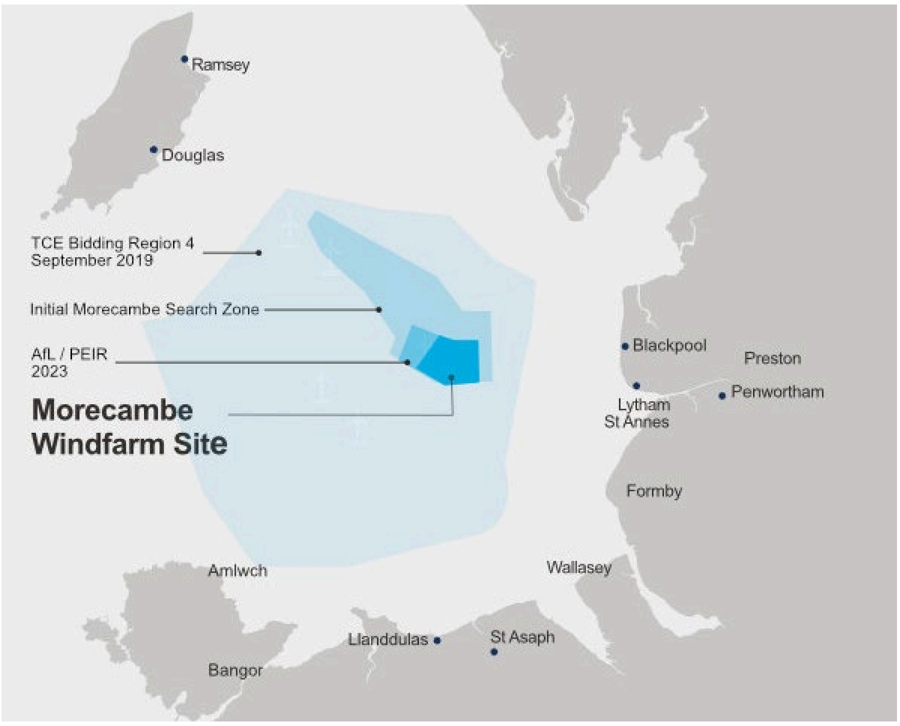

Plate 12 Refinement of final Morecambe Offshore Windfarm Site area

5.2 Layout

100. Once the extent of the Project site was established, the Applicant spent considerable time setting the parameters for the layout or siting of the individual WTGs. The Design Code (**Section 6.2**) establishes key control measures for the design of the final layout of the Project site. **Chapter 5 Project Description** (Document Reference 5.1.5) gives indicative details of the layout, which would follow a regular pattern, generally orientated perpendicular to the prevailing wind, or as close to this as is practicable. The final layout would be determined post-consent, following a design exercise, which would include a balance between various objectives, including the commercial need to maximise energy production, sufficient space between individual WTGs for navigation and SAR, appropriate separation from existing cables, pipelines or other infrastructure, and consideration of ground conditions and other constraints (such as archaeological exclusion zones).

101. For the Project, the proposed minimum distance between WTGs within a row of WTGs is 1,060m and the minimum distance between rows of WTGs is 1,410m. These minimum distances are defined by the smaller rotor diameter WTG in the Project design envelope and would give vessels and SAR sufficient room to manoeuvre per the advice shared in MGN654. The Applicant is proposing a maximum rotor diameter of 280m and, should this WTG be selected, the actual minimum separation distances may be greater, increasing navigational sea room as a consequence.

102. The presence of existing marine infrastructure imposes restrictions on how the layout would be arranged. There will be buffer zones centred around

existing oil and gas platforms and on either side of existing cables and pipelines which traverse the Project site. WTGs or OSP(s) would not be located in these buffer zones in order to reduce interactions between different users in the area of the windfarm site. The Applicant is continuing to engage with relevant parties, but the buffer zones are secured in Protective Provisions included in the **draft DCO** (Document Reference 3.1).

103. There is a preference for overall alignment of WTGs to have a sense of regularity, with multiple lines of orientation, as per the advice in MGN654. A single line of orientation would not be considered without justification and associated supporting documentation provided to the satisfaction of the MCA(1). Zero lines of orientation would be unacceptable to the MCA(1) in any case. The Applicant has committed in the Design Code (**Section 6.2**) to adopting two lines of orientation for the windfarm layout i.e. WTGs would be set out in a regular pattern such that they are aligned in two straight, intersecting rows. This commitment is in line with MGN654.

104. Refining the WTG layout is an iterative design process and requires input from several technical disciplines. The final layout would be informed by these criteria, as well as results from further ground investigation and surveys.

105. For the construction phase (and any major maintenance works) the Applicant intends to make an application for Safety Zones around the OREI (under the Energy Act 2004 and as provided for in the **draft DCO** (Document Reference 3.1), in order to ensure the safety of the windfarm infrastructure, individuals working thereon, construction vessels and other vessels navigating in the area whilst works take place. Further information on Safety Zones is provided in the **Safety Zone Statement** (Document Reference 4.5) and **Other Consents and Licences Required** (Document Reference 4.15).

5.3 Wind turbine generators

106. Each WTG is comprised of a tubular steel tower, atop a foundation structure. At the top of the tower is a nacelle, which hosts the electrical generator, and a hub connects the nacelle assembly to the rotor blades rotating around a horizontal axis.

107. The final selection of the number, size, colouring and type of WTGs would be determined post-consent and will be subject to approval under DML Conditions. All Project infrastructure, including WTGs and fixed substructures would be designed with sufficient safety margins for extreme weather events such as storm surges and high winds. The loads that the Project marine infrastructure is designed to withstand are developed on the basis of meteorological hindcast datasets, which correlate a long-term series of wind and wave data with satellite observations and real-time measurements and then extrapolated to account for extreme events.

108. At wind speeds above the design operational load limit, the WTGs would shut down, with the blades feathered and nacelle yawed to align to the wind direction, maintaining idle configuration to prevent structural damage during gusts or sustained high winds. Normal operations would resume once the wind speed returns below the cut-out speed.

109. The Applicant has reduced the maximum number of WTGs from 40 at PEIR to a maximum of 35 WTGs (as defined in the Project design envelope for the DCO submission). This decision was influenced by the rapid development of larger WTGs with increased generating capacity, meaning the Project nominal export capacity can be attained with fewer WTGs overall.

110. The maximum blade tip height is 310m above HAT and the maximum rotor diameter is 280m. This commitment defines the maximum height of WTGs that could be installed under the draft **DCO** (Document Reference 3.1). The maximum height of the WTGs was reduced from the 345m blade tip height considered in the PEIR, leading to a reduction in the Zone of Theoretical Visibility (ZTV) and apparent scale of the WTGs, thus helping reduce visual effects.

111. The proposed minimum WTG rotor clearance above sea level, also known as the "*air gap*", has been increased from 22m above HAT at PEIR to 25m above HAT. The increase in air gap has been designed with the intention of reducing potential seabird collision impacts.

112. The final number of WTGs would be decided post-consent and could, for example, be up to 30 WTGs with larger rotor diameters or up to 35 WTGs with smaller rotor diameters. The final design and selection of size and number of WTGs would optimise the gross energy output from the windfarm site on a consistent basis.

113. Since PEIR, the Applicant has reduced the range of foundation types provided for in the DCO Application. Fixed foundation types are suitable for the water depth across the windfarm site and four foundation types are being considered:

- Gravity based structure (GBS)
- Multi-legged pin-piled jacket (three-legged or four-legged jackets)
- Monopile
- Multi-legged suction bucket jacket (three-legged jackets)

114. The final foundation could be one type or a combination of foundation types. The decision would be informed by results of the pre-construction surveys, suitability of the ground conditions, water depths, procurement and the final WTG/OSP(s) design.

115. Standard colours are used across offshore windfarms in the UK to ensure these structures are visible to different sea and air users under various meteorological conditions. Colours would be agreed with the relevant authorities. The foundation structures are expected to be coloured RAL 1023 (traffic yellow) from HAT to a minimum of 15m above HAT, as directed by Trinity House (TH). Above this, the colour scheme for nacelles, blades and towers is expected to be RAL 7035 (light grey), unless otherwise specified.

116. Defining the number and size of WTGs is an iterative process, similar to the definition of the layout. The Design Code (**Section 6.2**) establishes key control measures for the number, size, colouring and type of WTGs to be deployed.

5.4 Offshore Substation Platform(s)

117. The Project will include up to two OSPs. The inter-array cables will collect the alternating current (AC) electrical power from the WTGs and will terminate at the OSP(s). The OSP(s) increase the voltage of the electricity generated by the WTGs, via the use of transformer(s), which is then transported to shore via export cables. The export cables form part of the Transmission Asset infrastructure which is subject to a separate consent application as part of the Morgan and Morecambe Offshore Wind Farms: Transmission Assets project. The OSP(s) would also provide welfare facilities for personnel to facilitate operation and maintenance activities.

118. Since PEIR, the Applicant has reduced the dimension parameters of the OSP(s) and these are defined in the **draft DCO** (Document Reference 3.1). The OSP(s) would have a maximum length of 50m and a maximum width of 50m. Similarly, the highest point of the OSP(s) topside structure (excluding helideck and lightening protection) would be 50m above HAT. These amendments would help to reduce seascape and visual impacts when viewed from the shoreline.

119. The final location of the OSP(s) would be decided post-consent. However, as set out in the Design Code Section 6.2, the OSPs shall be located within the windfarm site, with the exact locations to be determined, with consideration of micro siting allowances agreed in consultation with the MCA(1), including for seascape, landscape and visual impact reasons. The Design Code (**Section** establishes key control measures for the final design of the OSP(s), which will be subject to approval by the MMO under the DML.

5.5 Inter-array cables and platform link cables

120. Inter-array cables will connect WTGs in strings, subsequently connecting to the OSP(s). The inter-array cables would be between 66kV and 132kV AC and have a maximum total length of up to 70km.

121. Platform link cables would be necessary if the final design demonstrates that two OSPs are required. The platform link cables would be used to connect the two OSPs and would allow the transfer of generated power to ensure optimal use of transmission capacity. The maximum length of platform link cables would be 10km. If only one OSP is to be constructed, then platform link cables would not be required.

122. The inter-array cables and platform link cables would typically be buried for protection purposes to a target depth of 1.5m, although depth of burial could be between 0.5 and 3m, depending on the ground conditions. The final burial depth would be determined post-consent as confirmed by the results of the Cable Burial Risk Assessment (CBRA).

123. If burial of inter-array cables or platform link cables is not possible, for example due to unfavourable ground conditions, then cable protection measures would be deployed. Cable protection could include the use of rock placement (e.g. rock berms or gravel bags) or concrete mattresses. The type of protection to be used would be determined post-consent and is dependent on localised seabed conditions. Cable protection measures would also be deployed at cable crossings to protect cables.

124. The routing of the inter-array cables and platform link cables would be determined post-consent, depending on the seabed conditions and the location of WTGs and OSP(s). The Applicant would seek to use the most direct and efficient cable routes to minimise the amount of cabling. This approach is aimed to help minimise electrical losses, seabed and sediment disturbance and keep and installation costs as low as reasonably practicable.

125. The approach taken, as set out above, therefore demonstrates how good design, in the terms described in NPS EN-1 and EN-3, and the Project's Design Principles (Excellence in Safety, Functionality and Adaptability, Synergies and Re-use and Planet Positive considerations), have been brought to bear on design decisions from the outset of the Project and during its evolution.

6 Securing good design post-consent

6.1 Post-consent design process and governance

126. The DML within the **draft DCO** (Document Reference 3.1) requires design details to be submitted to and approved by the MMO prior to the commencement of construction. A condition of the DML in the **draft DCO** (Document Reference 3.1) would specifically require submission of:

"(a) design plan at a scale of between 1:25,000 and 1:50,000, including detailed representation on the most suitably scaled admiralty chart, to be approved in writing by the MMO setting out proposed details of the authorised project, including the:

- *(i) number, dimensions, specification, foundation type(s) for each wind turbine generator and offshore substation platform;*
- *(ii) the proposed layout of all wind turbine generators and offshore substation platforms (which shall provide for two lines of orientation and otherwise be in accordance with the recommendations for layout contained in MGN654 and its annexes), including grid coordinates of the centre point of the proposed location for each wind turbine generator and offshore substation platform;*
- *(iii) proposed specification and layout of all cables;*
- *(iv) location and specification of all other aspects of the authorised project; and*
- *(v) any archaeological exclusion zones*

to ensure conformity with the description of Work No. 1 and Work No. 2 and compliance with conditions 1 and2"

127. The Condition would also require submission and approval, post-consent, of:

- A construction programme
- A monitoring plan
- An offshore Construction Method Statement (CMS)
- An offshore Project Environmental Management Plan (PEMP)
- An offshore archaeological Written Scheme of Investigation (WSI)
- An Offshore Operations and Maintenance Plan (OOMP)
- An Aids to Navigation Maintenance Plan (AtNMP)
- A Marine Mammals Mitigation Protocol (MMMP)

128. The Project will continue the development of the design of all project elements, including inter-array cables and platform link cables, WTGs, OSP(s) and the layout of the Project windfarm site, in accordance with the PDE. All such design details would be submitted to the MMO for determination prior to commencement of construction.

129. In order to continue to ensure good design post-consent is embedded within the ongoing development of the Project design, and to guide and oversee this process, the Project will continue to use its design team, including qualified and chartered professional engineers, architects and landscape architects). The design team would continue to work closely as part of a multi-disciplinary team to progress the design in line with the Design Code and principles, including close interface with the supply chain, consenting, environmental, HSEQ and project management teams.

130. The Project has also appointed a senior level executive, reporting to the Board, Offshore Wind Limited's Projects Director, who has been appointed Design Champion for the Project, in order to advocate the Design Principles in the detailed design phase.

6.2 Post-consent Design Code

131. The Design Code has been developed by the Project design team in order to provide a basis to maintain good design throughout the process of finalising the detailed design post-consent. **Table 6.1** sets out the proposed Design Code items and corresponding Design Principles to which they give effect.

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Table 6.1 Post-consent Design Code

No.	Project Element	Design Code Item	Relevant Parameters in the Environmental Statement	Relevant Design Principles
DC1	General	The design of all elements of the Project shall comply with the parameters of the Authorised Development in Part 1 of Schedule 1, and Requirement 2 (Design Parameters) of Part 1 of Schedule 2 and all other provisions of the **draft DCO** (Document Reference 3.1), including DML, shall also apply.	**Chapter 5 Project Description** (Document Reference 5.1.5)	*General*
DC2	Layout	Any tolerance / micro siting applied will not reduce SAR lanes below 500m minimum width and will remain consistent with the parameters of the DCO including the Order Limits) and in accordance with MGN654 and its Annex 4: Guidance: Offshore renewable energy installations: impact on shipping.	**Chapter 5 Project Description** (Document Reference 5.1.5) Sections 5.5.1 & 5.5.2	*Functionality & Adaptability*
DC3	Layout	The position of WTGs shall be arranged in at least two consistent lines of orientation, and WTGs/OSP(s) shall be located within the windfarm, with the exact locations to be determined, with consideration of micro siting allowances agreed in consultation with the MCA(1), including for seascape, landscape and visual impact reasons. The spacing between these straight lines shall comply with MGN654 (i.e. SAR lanes will be at least 500 metres in width tip to tip).	**Chapter 5 Project Description** (Document Reference 5.1.5) Sections 5.5.1 & 5.5.2	*Planet Positive*
DC4	Layout	The position of all structures along the perimeter will be arranged, per the standards set out in MGN654, in order to aid visual navigation and to avoid outliers as far as is practicable within the shape of the Project site boundary.	**Chapter 5 Project Description** (Document Reference 5.1.5) Sections 5.5.1 & 5.5.2	*Excellence in Safety*
DC5	WTG and OSP design	The design of WTGs and OSP(s) will adhere to safety and design standards set out in MGN654 and its Annex 4: Guidance: Offshore renewable energy installations: impact on shipping.	**Chapter 5 Project Description** (Document Reference 5.1.5) Sections 5.5.1, 5.5.2 & 5.6	*Excellence in Safety*

No.	Project Element	Design Code Item	Relevant Parameters in the Environmental Statement	Relevant Design Principles
DC6	WTG	The air gap between sea level conditions at HAT and WTG rotors shall not be less than 25 metres.	**Chapter 5 Project Description** (Document Reference 5.1.5) Section 5.5.1	*Excellence in Safety* *Functionality & Adaptability* *Planet Positive*
DC7	Inter-array cables and platform link cables	Inter-array cables and platform link cables shall follow the most efficient route and minimise the use of cable protection as far as practicable.	**Chapter 5 Project Description** (Document Reference 5.1.5) Sections 5.5.4 & 5.5.6	*Functionality & Adaptability* *Planet Positive*

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