Bowdun Offshore Wind Farm, Offshore EIA Report

Volume 4, Appendix 30: Outline Scour Protection Management Plan

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Glossary

Defined term	Definition
Array Area	The Array Area is the area in which the Offshore Generation Assets will be located.
Bowdun Offshore Wind Farm Limited (BOWFL)	A Special Purpose Vehicle (SPV) (legal entity) for the purpose of developing the Project. BOWFL are the Applicant for the Offshore Application.
Developer (the)	Bowdun Offshore Wind Farm Limited (BOWFL) (also known as 'the Applicant' in pre-application and application documentation)
Environmental Impact Assessment (EIA)	Process for the assessment of likely significant environmental effects of a project on the physical, biological and human environment during construction, Operation and Maintenance (O&M) and decommissioning
Export Cable Corridor	The area seaward of Mean High Water Springs (MHWS) shaded in blue on Figure 1.1, which connects the Array Area with the Landfall Area within which the Offshore Export Cables will be installed.
Impact	A change caused by an action that occurs during a project's lifetime.
Inter-Array Cables (IAC)	Cables which link the Wind Turbines to each other and with the Offshore Substation Platforms (OSPs).
Interconnector Cables	Cables which will connect individual OSPs to each other to provide redundancy against cable failure elsewhere.
Marine Directorate (MD)	The Marine Directorate of the Scottish Government, formerly known as Marine Scotland. The planning and licensing authority for Scotland's seas and custodian of Scotland's National Marine Plan (NMP). The Marine Directorate - Licensing and Operations Team (MD-LOT) are specifically responsible for managing Section 36 Consent and Marine Licence Applications seaward of MHWS.
Maximum Design Scenario (MDS)	The scenario within the design envelope likely to result in the greatest impact on a particular topic receptor, and therefore the one that should be assessed for that topic receptor.
Offshore Environmental Impact Assessment (EIA) Report (hereafter, 'Offshore EIA Report')	Document prepared to report the findings of the EIA for the Proposed Development and produced in accordance with the EIA Regulations. Submitted to support the Offshore Application for the Proposed Development.
Offshore Export Cables	Subsea cables used to transmit electricity generated offshore by the Wind Turbines from the OSPs to shore. The Transition Joint Bay (TJB) is the location where the Offshore Export Cables terminate, and the onshore cabling begins.
Offshore Generation Assets	The infrastructure of the Proposed Development required to generate electricity comprising of the Wind Turbines, Wind Turbine foundations and associated infrastructure e.g. IACs.
Offshore Infrastructure	All of the Offshore Infrastructure associated with the Proposed Development that is located seaward of MHWS, comprising the Offshore Generation Assets and the Offshore Transmission Assets.

Defined term	Definition
Offshore Substation Platform(s) (OSPs)	OSPs comprise the support structure, topside and electrical components used for collecting and/or converting electricity generated by the Wind Turbines for transmission by the Offshore Export Cables.
Offshore Transmission Assets	The infrastructure of the Proposed Development required to transmit the generated electricity comprising of the OSPs, Offshore Export Cables and associated infrastructure up to MHWS.
Operation and Maintenance (O&M)	The phase of the Proposed Development following completion of construction. This phase of development includes routine inspections, repairs and replacement of infrastructure and equipment (including interconnector and IACs), scour protection replenishment or replacement, major component replacement, painting and/or other coating works, removal of marine growth, replacement of access ladders and geophysical surveys.
Option to Lease Agreement (OLA)	An agreement between CES and a developer, permitting the future development of offshore wind within an agreed area.
Plan Option Area (POA)	A location identified in the SMP as a preferred area for commercial scale offshore wind development.
Project (the)	An overarching term for the Bowdun Offshore Wind Farm (Bowdun OWF) comprising the offshore and onshore infrastructure required to generate and transmit electricity from the Array Area to the onshore Grid Connection Point (GCP). The Project includes the Offshore Generation Assets, the Offshore Transmission Assets and the Onshore Infrastructure.
Proposed Development	Term used to define the Offshore Infrastructure associated with the Project seaward of MHWS for which consent is being sought. Further details of the parameters are included in Volume 1, Chapter 3: Project Description.
Scour Protection	Protective materials installed to avoid sediment being eroded away from the base of the foundations and/or buried subsea cable due to the flow of water.
Sectoral Marine Plan (SMP)	A plan developed by the Scottish Government which provide the strategically planned spatial footprint for offshore wind development in Scotland.
Thistle Wind Partners (TWP)	The Joint Venture (JV) of DEME Concessions, Qair Marine, and Aspiravi International.
Wind Turbines	Structures comprising of a tubular tower, rotor blades, and a nacelle which houses the Wind Turbine generator.

Acronyms

Acronym	Definition
CBRA	Cable Burial Risk Assessment
CPS	Cable Protection System
EIA	Environmental Impact Assessment
FEED	Front-End Engineering Design
IAC	Inter-Array Cable
ITT	Invitation to Tender
MD-LOT	Marine Directorate - Licensing Operations Team
MDS	Maximum Design Scenario
O&M	Operation and Maintenance
OLA	Option Lease Agreement
OSP	Offshore Substation Platform
POA	Plan Option Area
SMP	Sectoral Marine Plan
SPMP	Scour Protection Management Plan
TWP	Thistle Wind Partners

Table of Units

Units	Definition
km	Kilometre
km^2	Square kilometre
m	Metre
m^2	Square Metre
m^3	Cube Metre
%	Percent

1 Introduction

1.1 Purpose of this Document

1.1.1 This Outline Scour Protection Management Plan (SPMP) has been prepared by ERM on behalf of Bowdun Offshore Wind Farm Limited (BOWFL) (the Developer) for the offshore elements of the Bowdun Offshore Wind Farm Project (hereafter referred to as the Proposed Development). The Proposed Development covers the Option Lease Area that which is located in the E3 Plan Option Area (POA) detailed in the Scottish Sectoral Marine Plan (Scottish Government, 2020), and the Export Cable Corridor. The Array Area is located 38 km from the Aberdeenshire coast at its closest point, covering an area of 187 km^2 (Figure 1.1). The Proposed Development will comprise of Wind Turbines (fixed foundations), Inter-Array Cables (IACs), Substation Platforms (OSPs), Interconnector Cables, Offshore Export Cables and any necessary scour/cable protection. The Export Cable Corridor will include a maximum of three High Voltage Alternating Current (HVAC) Offshore Export Cables, each with a length of up to 70 km and will make landfall at Benholm, Aberdeenshire.

1.1.2 The purpose of the SPMP is to outline the key principles for managing the protection of Wind Turbines, OSP foundations, Offshore Export Cables, IACs and Interconnector Cables, from the effects of scour and hazards (e.g. snagging), immediately following construction and during the Operation and Maintenance (O&M) phase of the Proposed Development. Any infrastructure protection laid as part of the Proposed Development has the potential to scour, which can be described as the movement of sediment that can erode the seabed around a fixed structure.

1.1.3 This SPMP is a 'live' document and as such it will be further developed pre-construction in consultation with regulatory bodies and stakeholders such as the Marine Directorate - Licencing Operations Team (MD-LOT), and NatureScot, once the design of the Proposed Development has been finalised.

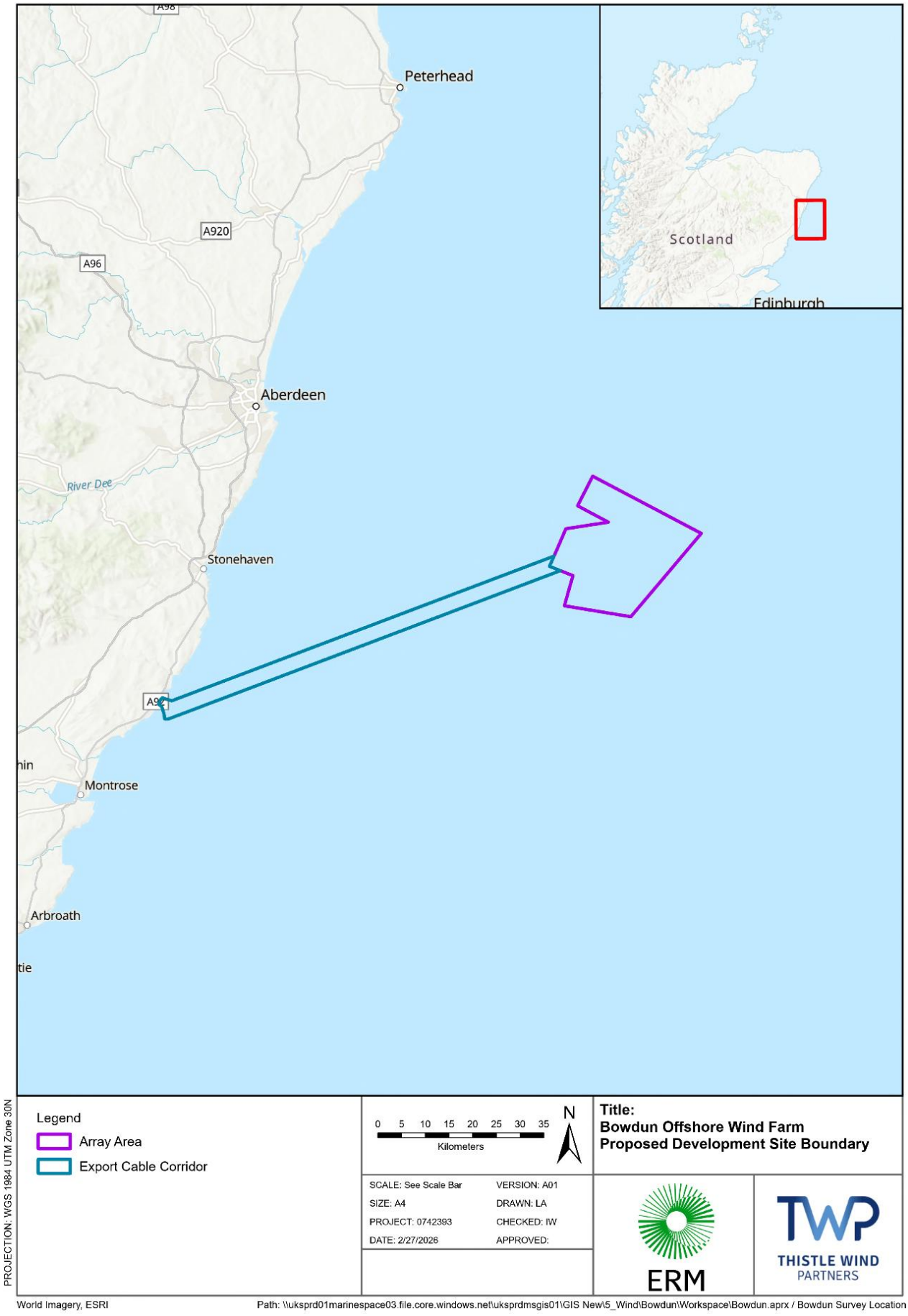

Figure 1.1: Proposed Development Site Boundary

1.2 Other Relevant Consent Plans

1.2.1 This document is one of several consent plans which requires approval from MD-LOT regarding the compliance with relevant Section 36 and Marine Licence conditions.

1.2.2 Where additional information which is linked to this SPMP is provided in a separate document, these have been summarised in Table 1.1 below.

Table 1.1: Other Relevant Consent Plans

Relevant Plan	Link to SPMP	Relevant Section
[to be updated pre-construction]	[to be updated pre-construction]	[to be updated pre-construction]

1.3 Background

1.3.1 The main components of the Proposed Development, as shown in Table 2.1, Table 3.1 and Table 3.3, include:

Offshore Generation Assets

- Up to 67 Wind Turbines (each comprised of three rotor blades, a nacelle housing the generating unit, hub and tower section) and associated supporting structures which will be fixed foundations
- A network of up to 167 km of IACs which will be static cables;
- Up to 36 km of Interconnector Cables; and
- Scour Protection, cable protection and utility crossings.

Offshore Transmission Assets

- Up to three OSPs with fixed foundations and supporting infrastructure including scour protection (as required);
- Up to three Offshore Export Cables totalling approximately 210 km in length; and
- Cable protection and utility crossings where required.

1.3.2 A full description of the Proposed Development is provided in Volume 1, Chapter 3: Project Description of the Offshore Environmental Impact Assessment (EIA) Report (hereafter, 'Offshore EIA Report'). However, the detailed and final design of the Proposed Development will be determined pre-construction.

2 Foundation Scour Protection

2.1.1 Physical processes within the Site Boundary will influence the effects of scour upon Wind Turbine and OSP foundations and cables. Therefore, depending on metocean conditions, scour and cable protection may be required around Offshore Infrastructure to protect against currents and waves that may cause erosion of the seabed.

2.1.2 A number of factors influence the development of scour, including the shape of structures on the seabed, seabed sedimentology, and site-specific metocean conditions (e.g. currents, tides, waves and storms). Commonly used Scour Protection types include:

- Rock: the most frequently used Scour Protection method. Layers of graded stones placed on and/or around structures (e.g. foundation structures), either prior or following installation of structures to inhibit erosion, or rock filled mesh fibre bags which adapt to the shape of the seabed/structure as they are lowered on to it; or
- Concrete mattresses: cast of articulated concrete blocks, several metres wide and long and linked by a polypropylene rope lattice, which are placed on and/or around structures to stabilise the seabed and inhibit erosion.

2.1.3 The type and volume of Scour Protection required will vary depending on the various Wind Turbine and OSP foundation options. The final parameters will be decided once the design of these is finalised pre-construction. This decision will consider a range of aspects including geotechnical data, meteorological and oceanographical data, water depth, foundation type, maintenance strategy and cost.

2.1.4 The process for developing the Scour Protection design will follow the below steps:

- Design of Scour Protection
  - pre-construction surveys to inform concept design;
  - Front-End Engineering Design (FEED) design studies; and
  - Full Invitation to Tender (ITT) to produce detailed design of Scour Protection;
- Completion of pre-installation surveys (e.g. geophysical surveys), to inform preparation of the SPMP; and
- Production of detailed SPMP for submission and approval by MD-LOT prior to construction.

2.1.5 Scour Protection material is likely to be installed at Wind Turbine and OSP foundations, if required, during the construction phase, to mitigate the effects of scour, to minimise the release of suspended sediments, and to minimise the potential for seabed level changes in the vicinity of the Proposed Development.

2.1.6 The maximum design scenario (MDS) for foundation Scour Protection required at the Proposed Development is provided in Volume 1, Chapter 3: Project

Description of the Offshore EIA Report. These parameters are summarised in Table 2.1 below.

Table 2.1: MDS for Scour Protection for Foundation Options

Parameter	Maximum Design Scenario			
	4-legged fixed Wind Turbine foundation	Fixed OSP foundation options		
		6-leg	8-leg	4-leg
Maximum number of Wind Turbines/OSPs	67	3		
Scour Protection type	Rock	Rock		
Maximum height of Scour Protection (m)	1	1		
Maximum diameter of Scour Protection (including pile) (m)	28.8	40		29
Maximum area of Scour Protection per foundation (excluding pile area) (m^2)	2,606	7,500	10,000	5,000
Maximum volume of Scour Protection per foundation (m^3)	2,606	7,500	10,000	5,000
Maximum volume of Scour Protection for Proposed Development (m^3)	174,586	15,000	10,000	15,000

3 Cable Protection

3.1.1 Cable protection will be required due to cable crossings and substrate type, the type of cable protection used will be dependent on several factors such as seabed conditions, seabed sedimentology and naturally occurring physical processes. For the purposes of this section, the term unburied cables also includes buried cables where required target burial depths (1.5 m subject to the Cable Burial Risk Assessment (CBRA) are not met.

3.1.2 The process for developing the cable protection design will follow the below steps:

- Design of cable protection:
  - pre-construction surveys to inform concept design;
  - FEED design studies;
  - production of a CBRA and Cable Burial Assessment. Results of these assessments, and commitments to post construction monitoring will be provided in the Cable Plan; and
  - full ITT to produce detailed design of cable protection including types and locations; and
- Production of detailed SPMP (or Cable Burial and Protection Plan as appropriate) for submission and approval by MD-LOT prior to construction which will detail locations, quantities, types of cable protection.

3.1.3 The MDS for cable protection for the Offshore Export Cables is provided in Volume 1, Chapter 3: Project Description of the Offshore EIA Report and is summarised in Table 3.1 below.

Table 3.1: MDS for the External Cable Protection for the Offshore Export Cables

Parameter	Maximum Design Scenario
Type	Cable Protection System (CPS) (typically made of cast-iron, stell, PU/PE, e.g. articulated split pipes, uraduct or protective sleeves), rock dumping, grout bags, rock berms, rock bags, and concrete mattresses.
Maximum cable protection height (m)	2
Maximum cable protection width (m)	10
Maximum percentage of cables which may require cable protection (%)	50
Maximum length of cables which may require cable protection (m)	105,000
Maximum total cable protection footprint area for Export Cables(m^2)	1,050,000
Maximum total cable protection volume for Export Cables (m^3)	2,100,000

3.1.4 The MDS for cable protection for the IACs and Interconnector cables is provided in Volume 1, Chapter 3: Project Description of the Offshore EIA Report and is summarised in Table 3.2 below.

Table 3.2 PDE for External Cable Protection for IACs and Interconnector Cables

Parameter	Maximum Design	
	IACs	Interconnector Cables
Type	CPS (typically made of cast-iron, steel, PU/PE, e.g. articulated split pipes, uraduct or protective sleeves), rock placement, grout bags, rock berms, rock bags, and concrete mattresses	
Maximum cable protection height (m) above seabed	2	
Maximum cable protection width (m)	10	
Maximum percentage of cables which may require cable protection (%)	50	
Maximum length of cables which may require cable protection (m)	75,500	18,000
Maximum total cable protection footprint area for Array Area (m^2)	755,000	180,000
Maximum total cable protection volume for Array Area (m^3)	1,510,000	360,000

3.1.5 The cable installation methodology and requirements for cable protection will be finalised pre-construction based on the process outlined above.

3.2 Cable Crossings

3.2.1 The need for additional external protection will be subject to whether minimum target cable burial depths recommended for protection from the external threats can be achieved. Additional external protection will also be required at cable crossings where cables cross existing assets. Seabed conditions, sedimentology, naturally occurring physical processes and potential interactions with human activities, such as vessel anchoring and bottom-trawl fishing gear, are all factors that can influence the requirement for the need of additional protection.

3.2.2 Where a cable crossing is for a third-party cable, this would require an agreed procedure between the cable owners, with the agreement being finalised pre-construction, following any additional pre-construction surveys.

3.2.3 The Offshore Export Cable for the Proposed Development will cross a maximum of six cables. The MDS for these crossings are provided in Volume 1, Chapter 3: Project Description of the Offshore EIA Report and are summarised in Table 3.3 below.

Table 3.3: MDS for Cable Crossings for the Offshore Export Cable

Parameter	Maximum Design Scenario
Maximum number of crossings	6
Crossing material/method	CPS (typically made of cast-iron, stell, PU/PE, e.g. articulated split pipes, uraduct or protective sleeves), rock placement, grout bags, rock berms, rock bags, and concrete bridges and concrete mattresses
Maximum height of crossing (m)	2.5
Maximum width of crossing (m)	9
Maximum length of each crossing (m)	500
Maximum length of crossings along the Export Cable Corridor (m)	3,000
Maximum total area of crossings (m^2)	27,000
Maximum volume of protection material (per crossing) (m^3)	11,250
Maximum total volume of crossing protection (m^3)	67,500

3.2.4 Up to nine IAC crossings and up to three Interconnector Cable crossings may be required across the Array Area. The MDS for these crossings are provided in Volume 1, Chapter 3: Project Description of the Offshore EIA Report and are summarised in Table 3.4 below.

Table 3.4: MDS for Cable Crossings for the IACs and Interconnectors

Parameter	Maximum Design	
	IACs	**Interconnector Cables**
Maximum number of crossings	9	3
Crossing material/method	Rock placement, grout/rock bags, rock berms, concrete bridges and concrete mattresses, and CPS (typically made of cast-iron, steel, PU/PE, e.g. articulated split pipes, uraduct or protective sleeves)	
Maximum height of crossing above seabed (m)	2.5	
Maximum width of crossing (m)	9	
Maximum length of each crossing (m)	500	
Maximum length of crossings across the Array Area (m)	4,500	1,500
Maximum total area of crossings (m^2)	40,500	13,500
Maximum volume of protection material (per crossing) (m^3)	11,250	
Maximum total volume of crossing protection across the Array Area (m^3)	101,250	33,750

4 Scour and Cable Protection Assessment in Offshore EIA Report

4.1.1 The Offshore EIA Report has assessed the potential impacts relating to the presence of scour and cable protection during the O&M phase of the Proposed Development. These assessments have been carried out based on the MDS relevant to a given potential impact.

4.1.2 Details of where in the Offshore EIA Report these impacts have been considered are summarised in Table 4.1 below.

Table 4.1: Impacts Relating to Scour and Cable Protection Assessed in the Offshore EIA Report

Offshore EIA Report Chapter	Impacts Assessed
Chapter 7: Physical Processes	Potential for scour of seabed sediments from Offshore Infrastructure.
Chapter 7: Physical Processes	Potential impacts to seabed morphology from the presence of cable protection.
Chapter 7: Physical Processes	Potential impacts to Landfall morphology from scour and cable protection.
Chapter 7: Physical Processes	Potential changes to the sediment transport regime from cable protection.
Chapter 8: Benthic Ecology **Chapter 9: Fish and Shellfish Ecology**	Long term habitat loss and/or disturbance from the installation of Offshore Infrastructure, scour protection and cable protection on the seabed.
Chapter 8: Benthic Ecology	Changes in physical processes due to the presence of structures on or near the seabed (such as foundations, scour protection and cable protection).
Chapter 8: Benthic Ecology	Increased risk of introduction and spread of Invasive Non-Native Species (INNS) due to the installation of artificial hard structures (such as foundations, scour protection, and cable protection) which may represent increased available habitat for INNS to colonise in the O&M phase.
Chapter 8: Benthic Ecology **Chapter 9: Fish and Shellfish Ecology**	Introduction of artificial structures and subsequent colonisation of foundations, scour protection, and cable protection.
Chapter 13: Commercial Fisheries	Increased snagging risk, which could result in loss or damage to fishing gear.
Chapter 13: Commercial Fisheries	Reduction in access to, or exclusion from established fishing grounds within the Array Area.
Chapter 13: Commercial Fisheries	Reduction in access to, or exclusion from established fishing grounds within the Export Cable Corridor
Chapter 13: Commercial Fisheries	Displacement leading to gear conflict and increased fishing pressure on adjacent grounds.
Chapter 13: Commercial Fisheries	Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the Proposed Development

Offshore EIA Report Chapter	Impacts Assessed
Chapter 14: Shipping and Navigation	Deviation of commercial vessels due to cable protection.
Chapter 14: Shipping and Navigation	Increased grounding risk from cable protection.
Chapter 14: Shipping and Navigation	Reduction in Under Keel Clearance due to subsurface Offshore Infrastructure including cable protection.
Chapter 14: Shipping and Navigation	Impact on port/harbours and nearshore operations.
Chapter 14: Shipping and Navigation	Impact on small vessel activity (fishing/recreational).
Chapter 16: Infrastructure and Other Users	Displacement of recreational activities (including recreational sailing, cruising and recreational fishing).
Chapter 16: Infrastructure and Other Users	Impacts to development cables or pipelines or restrictions on access to cables or pipelines.
Chapter 19: Marine Archaeology	Alteration of sediment transport regimes and scour.
Chapter 19: Marine Archaeology	Direct damage to maritime archaeology receptors.
Chapter 22: Climate Change	The impact of GHG emissions arising from the disturbance of Blue Carbon systems and seabed change, including benthic and subtidal/intertidal ecology, during the construction, O&M and decommissioning phases.
Chapter 22: Climate Change	The impact of GHG emissions arising from the manufacturing and installation of the Proposed Development.

5 Summary

5.1.1 Details relating to scour and cable protection have been provided in Volume 1, Chapter 3: Project Description of the Offshore EIA Report and potential impacts have been assessed in the relevant chapters of the Offshore EIA Report (summarised in Table 4.1).

5.1.2 Flexibility is required in terms of type and quantity of scour and cable protection and it will be further developed pre-construction, therefore the assessments have been carried out on a MDS basis.

5.1.3 Detailed requirements for scour and cable protection will be agreed pre-construction as part of the final SPMP and CBRA which will be submitted to MD-LOT for approval prior to construction.