MORGAN AND MORECAMBE OFFSHORE WIND FARMS: TRANSMISSION ASSETS

Environmental Statement

Volume 2, Chapter 2: Benthic subtidal and intertidal ecology

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RPS

Prepared for:

Morgan Offshore Wind Limited, Morecambe Offshore Wind Farm Ltd

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Glossary

Term	Meaning
Annelids	Any worms of the phylum Annelida that comprises the segmented worms, which include earthworms, lugworms, ragworms, and leeches.
Applicants	Morgan Offshore Wind Limited (Morgan OWL) and Morecambe Offshore Windfarm Limited (Morecambe OWL).
Arthropods	Invertebrates in the phylum Arthropoda which includes a wide diversity of animals with hard exoskeletons and jointed appendages.
Benthic Ecology	Benthic ecology encompasses the study of the organisms living in and on the sea floor, the interactions between them and impacts on the surrounding environment.
Biotope	The combination of physical environment (habitat) and its distinctive assemblage of conspicuous species.
Commitment	This term is used interchangeably with mitigation and enhancement measures. The purpose of commitments is to avoid, prevent, reduce or, if possible, offset significant adverse environmental effects. Primary and tertiary commitments are taken into account and embedded within the assessment set out in the ES.
Cumulative Effects	The combined effect of the Transmission Assets in combination with the effects from other proposed developments, on the same receptor or resource.
Drop down video	A survey method in which imagery of habitat is collected, used predominantly to survey marine environments.
Deposit feeder	Organisms which move along the surface or burrow within soft sediments and ingest some part of the sediment, digesting and assimilating some of the non-living and living organic matter.
Echinoderm	A marine invertebrate of the phylum Echinodermata, such as a starfish, sea urchin, or sea cucumber.
Environmental Impact Assessment	The process of identifying and assessing the significant effects likely to arise from a project. This requires consideration of the likely changes to the environment, where these arise as a consequence of a project, through comparison with the existing and projected future baseline conditions.
Environmental Statement	The document presenting the results of the Environmental Impact Assessment process.
Epifauna	The animals living on top of the seabed.
Epibenthic	Benthic invertebrates living on the surface of the seabed.
Expert Working Group	A forum for targeted engagement with regulators and interested stakeholders through the Evidence Plan process.
Filter feeder	A sub-group of suspension feeding animals that feed by straining suspended matter and food particles from water, typically by passing the water over a specialised filtering structure.

Term	Meaning
Generation Assets	The generation assets associated with the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm include the offshore wind turbines, inter-array cables, offshore substation platforms and platform link (interconnector) cables to connect offshore substations.
Habitat	The environment that a plant or animal lives in.
Infauna	The animals living in the sediments of the seabed.
Infralittoral	A subzone of the sublittoral in which upward-facing rocks are dominated by erect algae.
Intertidal area	The area between Mean High Water Springs and Mean Low Water Springs.
Invasive species	An introduced organism that becomes overpopulated and negatively alters its new environment.
Landfall	The area in which the offshore export cables make landfall (come on shore) and the transitional area between the offshore cabling and the onshore cabling. This term applies to the entire landfall area at Lytham St. Annes between Mean Low Water Springs and the transition joint bay inclusive of all construction works, including the offshore and onshore cable routes, intertidal working area and landfall compound(s).
Mollusca	Phylum of invertebrates which have a soft unsegmented body, commonly protected by a calcareous shell.
Morecambe Offshore Windfarm: Generation Assets	The offshore generation assets and associated activities for the Morecambe Offshore Windfarm.
Morecambe OWL	Morecambe Offshore Windfarm Limited is a joint venture between Zero-E Offshore Wind S.L.U. (Spain) (a Cobra group company) (Cobra) and Flotation Energy Ltd.
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	The offshore and onshore infrastructure connecting the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm to the national grid. This includes the offshore export cables, landfall site, onshore export cables, onshore substations, 400 kV grid connection cables and associated grid connection infrastructure such as circuit breaker compounds. Also referred to in this report as the Transmission Assets, for ease of reading.
Morgan Offshore Wind Project: Generation Assets	The offshore generation assets and associated activities for the Morgan Offshore Wind Project.
Morgan OWL	Morgan Offshore Wind Limited is a joint venture between bp Alternative Energy investments Ltd. and Energie Baden-Württemberg AG (EnBW).
National Policy Statement(s)	The current national policy statements published by the Department for Energy Security and Net Zero in 2023.
Offshore booster station	A fixed structure located along the offshore export cable route, containing electrical equipment to ensure bulk wind farm capacity can be fully transmitted to the onshore substations.
Offshore export cables	The cables which would bring electricity from the offshore substation platform to the landfall.

Term	Meaning
Offshore export cable corridor	The corridor within which the offshore export cables will be located.
Offshore substation platform(s)	A fixed structure located within the wind farm sites, containing electrical equipment to aggregate the power from the wind turbine generators and convert it into a more suitable form for export to shore.
Polychaete	A class of segmented worms often known as bristleworms.
SACFOR classification	A measure of abundance which records species in terms of percentage cover or counts and categorises in to superabundant, abundant, common, frequent, occasional and rare.
Species	A group of living organisms consisting of similar individuals capable of exchanging genes or interbreeding.
Sublittoral	Area extending seaward of low tide to the edge of the continental shelf.
Subtidal	Area extending from below low tide to the edge of the continental shelf.
Transmission Assets	See Morgan and Morecambe Offshore Wind Farms: Transmission Assets (above).
Transmission Assets Order Limits	The area within which all components of the Transmission Assets will be located, including areas required on a temporary basis during construction and/or decommissioning (such as construction compounds).
Transmission Assets Order Limits: Offshore	The area within which all components of the Transmission Assets seaward of Mean Low Water Springs will be located, including areas required on a temporary basis during construction and/or decommissioning.
Transmission Assets Order Limits: Offshore and Intertidal	The area within which all components of the Transmission Assets seaward of Mean High Water Springs will be located, including areas required on a temporary basis during construction and/or decommissioning (such as construction compounds).
Zone of influence	The horizontal distance over which a water particle may move during one cycle of flood and ebb.

Acronyms

Acronym	Meaning
AC	Alternating current
AL	Action Level
BAP	Biodiversity Action Plan
BEIS	Department for Business, Energy and Industrial Strategy
BNG	Biodiversity Net Gain
CBRA	Cable Burial Risk Assessment
CCS	Carbon Capture and Storage

Acronym	Meaning
CCW	Countryside Council for Wales
CEA	Cumulative Effects Assessment
Cefas	Centre for Environment Fisheries and Aquaculture Science
CIEEM	Chartered Institute of Ecology and Environmental Management
CMACS	Centre for Marine and Coastal Studies
CMS	Construction Method Statement
CSIP	Cable Specification and Installation Plan
DCO	Development Consent Order
DDV	Drop Down Video
Defra	Department for Environment, Food and Rural Affairs
DESNZ	Department for Energy Security and Net Zero
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMODnet	European Marine Observation and Data Network
EMP	Environmental Management Plan
EPP	Evidence Plan Process
ERL	Effect Range Low
ES	Environmental Statement
EWG	Expert Working Group
HDD	Horizontal Directional Drilling
HRA	Habitats Regulations Assessment
HVAC	High Voltage Alternating Current
IEF	Important Ecological Features
IEMA	Institute for Environmental Management and Assessment
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
JNCC	Joint Nature Conservation Committee
MarESA	Marine Evidence based Sensitivity Assessment
MCA	Maritime and Coastguard Agency
MCZ	Marine Conservation Zones
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs

Acronym	Meaning
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MNR	Marine Nature Reserves
MPCP	Marine Pollution Contingency Plan
MPS	Marine Policy Statement
NBN	National Biodiversity Network
NPS	National Policy Statements
OIPMP	Offshore In-Principal Monitoring Plan
OSP	Offshore substation platform
OSPAR	Oslo-Paris convention for the protection of the marine environment of the North-Eastern Atlantic
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PEIR	Preliminary Environmental Information Report
PEL	Probable Effect Level
SAC	Special Areas of Conservation
SNCBs	Statutory Nature Conservation Bodies
SPA	Special Protection Areas
SPM	Suspended Particulate Matter
SSC	Suspended Sediment Concentrations
TEL	Threshold Effect Level
UK	United Kingdom
UXO	Unexploded Ordnance
ZOI	Zone of Influence

Units

Unit	Description
%	Percentage
km	Kilometre
m	Metre
cm	Centimetre
km^2	Kilometres squared
m^2	Metres squared
m^3	Cubic metre
m/s	Metres per second (Speed)

Unit	Description
nm	Nautical mile
mg	Milligrams
mg/l	Milligrams per litre
µg	Microgram
µT	Micro Tesla
mG	Milligauss
kV	Kilovolt
mV	Millivolt
MW	Megawatts
l	Litre
°C	Degrees centigrade
V/m	Volt per metre

2 Benthic subtidal and intertidal ecology

2.1 Introduction

2.1.1.1 This chapter of the Environmental Statement (ES) presents the findings of the Environmental Impact Assessment (EIA) undertaken for the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. For ease of reference, the Morgan and Morecambe Offshore Wind Farms Transmission Assets are referred to in this chapter as the 'Transmission Assets'. This ES accompanies the application to the Planning Inspectorate for development consent for the Transmission Assets.

2.1.1.2 The purpose of the Transmission Assets is to connect the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets (referred to collectively as the 'Generation Assets') to the National Grid. A description of the Transmission Assets can be found in Volume 1, Chapter 3: Project description of the ES.

2.1.1.3 This chapter considers the likely impacts and effects of the Transmission Assets on benthic subtidal and intertidal ecology during the construction, operation and maintenance, and decommissioning phases. Specifically, it relates to the offshore elements of the Transmission Assets seaward of Mean High Water Springs (MHWS).

2.1.1.4 This ES chapter:

- identifies the key legislation, policy and guidance relevant to benthic subtidal and intertidal ecology;
- details the EIA scoping and consultation process undertaken to date for benthic subtidal and intertidal ecology;
- confirms the study area for the assessment, the methodology used to identify baseline environmental conditions and sets out the existing and future environmental baseline conditions, established from desk studies, surveys and consultation;
- identifies the scope of the assessment;
- details the mitigation and/or monitoring measures that are proposed to prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process;
- defines the design parameters used to inform the impact assessment;
- identifies the impact assessment methodology and presents an assessment of the likely impacts and effects in relation to the construction, operation and maintenance, and decommissioning phases of the Transmission Assets on benthic subtidal and intertidal ecology (and, where relevant, the impacts and effects of benthic subtidal and intertidal ecology on the Transmission Assets); and

- identifies any cumulative, transboundary and/or inter-related effects in relation to the construction, operation and maintenance and decommissioning phases of the Transmission Assets on benthic subtidal and intertidal ecology.

2.1.1.5 The assessment presented is informed by the following technical chapters and should be read in conjunction with:

- Volume 2, Chapter 1: Physical processes of the ES.

2.1.1.6 This chapter also draws upon additional information to support the assessment contained within:

- Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.

2.2 Legislation, policy and guidance

2.2.1 Legislation

2.2.1.1 The full relevant legislative context for the Transmission Assets has been detailed in Volume 1, Chapter 2: Policy and legislation context of the ES, with the legislation outlined below being the most relevant to benthic subtidal and intertidal ecology.

Marine and Coastal Access Act 2009

2.2.1.2 Parts 3 and 4 of the Marine and Coastal Access Act 2009 introduced a new marine planning and licensing system for overseeing the marine environment and a requirement to obtain a marine licence for certain activities and works at sea. Section 149A of the Planning Act 2008 allows applicants for development consent to apply for 'deemed marine licences' as part of the consenting process.

2.2.1.3 Part 5 of the Marine and Coastal Access Act 2009 enables the designation of Marine Conservation Zones (MCZs) in England and Wales as well as UK offshore areas. Consideration of MCZs is required for any marine licence application or application for development consent which includes a deemed marine licence, with this directly relevant to the Transmission Assets overlapping with the Fylde MCZ.

Habitats Regulations

2.2.1.4 In England and Wales, the Conservation of Habitats and Species Regulations 2017 (onshore and out to 12 nautical miles (nm)) and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (between 12 nm and 200 nm), collectively referred to as "the Habitats Regulations", are the principal means by which the Habitats Directive (Council Directive 92/43/EEC) and certain elements of the Wild Birds Directive (Directive 2009/147/EC) are transposed into UK law. The Habitats Regulations remain in force following the United Kingdom's departure from the EU, subject to certain amendments. These regulations require the assessment of significant effects on internationally important nature conservation sites, including:

- Special Areas of Conservation (SACs) or candidate SACs;
- Special Protection Areas (SPAs) or potential SPAs; and
- Sites of Community Importance.

2.2.1.5 Sites designated under the United Nations Convention on Wetlands of International Importance (signed in Ramsar, 1979) are protected by UK government policies which mandate the treatment of Ramsar Sites in the same manner as sites protected under the Birds and Habitats Directives.

2.2.1.6 These designated sites have been given full consideration in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES and are given further consideration within this chapter where the impacts are deemed likely to have an effect.

Environment Act 2021

2.2.1.7 The Environment Act 2021 sets out targets, plans and policies for environmental protection in England. Schedule 15 of the Environment Act 2021 sets out provisions for Biodiversity Net Gain (BNG) and amends the Planning Act 2008. Following a BNG consultation with stakeholders (Department for Environment, Food and Rural Affairs (Defra), 2023), the Government will produce a draft biodiversity gain statement for Nationally Significant Infrastructure Projects in 2024 and begin to consult with industry and wider stakeholders on this draft as soon as possible, with the requirement to incorporate BNG in place no later than November 2025. The Government encourages projects to adopt BNG earlier on a voluntary basis wherever possible.

2.2.1.8 The stated intention for the requirements of the Environment Act 2021 in relation to biodiversity to be implemented no later than 2025 will temporally overlap with the ongoing development of the Transmission Assets but will only apply to Development Consent Orders (DCOs) submitted after that date and will not directly apply to the Transmission Assets.

2.2.2 Planning policy context

2.2.2.1 The Transmission Assets will be located in English offshore waters (beyond 12 nm from the English coast) and inshore waters (within 12 nm from the English coast), with the onshore infrastructure located wholly within England. As set out in Volume 1, Chapter 1: Introduction of the ES, the Secretary of State for the Department for Business, Energy and Industrial Strategy (the department which preceded the Department for Energy Security and Net Zero (DESNZ)) has directed that the Transmission Assets are to be treated as development for which development consent is required under the Planning Act 2008, as amended.

National Policy Statements

2.2.2.2 There are currently six energy National Policy Statements (NPSs), three of which contain policy relevant to offshore wind development and the Transmission Assets, specifically:

- Overarching NPS for Energy (NPS EN-1) which sets out the UK Government's policy for the delivery of major energy infrastructure (Department for Energy Security & Net Zero 2023a);
- NPS for Renewable Energy Infrastructure (NPS EN-3) (Department for Energy Security & Net Zero 2023b); and
- NPS for Electricity Networks Infrastructure (NPS EN-5) (Department for Energy Security & Net Zero 2023c).

2.2.2.3 Although NPS: EN-1, EN-3, and EN-5 all contain policy relevant to offshore wind development, only NPS EN-1 and NPS EN-3 include guidance on what matters are to be considered in the benthic subtidal and intertidal ecology assessment, thus NPS EN-5 is not considered further within this chapter.

2.2.2.4 **Table 2.1** sets out a summary of the policies within the current NPS EN-1 and NPS EN-3, relevant to benthic subtidal and intertidal ecology.

2.2.2.5 The policies within the current NPSs relevant to all topics in the ES can be viewed in the National Policy Statement tracker (document reference J26) and Planning Statement (document reference J28), submitted with the Application.

Table 2.1: Summary of the NPS EN-1 and NPS EN-3 policies relevant to this chapter

Summary of NPS provision	How and where considered in the ES
NPS EN-1	
The applicant must provide information proportionate to the scale of the project, ensuring the information is sufficient to meet the requirements of the EIA Regulations. [Paragraph 4.3.10]	The scoping process (as detailed in section 5.2 of the Morgan and Morecambe Offshore Wind Farms: Transmission Assets EIA Scoping Report (Morgan Offshore Wind Ltd. and Morecambe Offshore Windfarm Ltd., 2022)) enabled the Transmission Assets to deliver environmental information proportionate to the infrastructure. This is demonstrated in this chapter in regard to the justification of the impact pathways scoped in and out (**section 2.7**) as this demonstrates a proportionate approach.
Many Sites of Special Scientific Interest (SSSIs) are also designated as sites of international importance and will be protected accordingly. Those that are not, or those features of SSSIs not covered by an international designation, should be given a high degree of protection. Most National Nature Reserves are notified as SSSIs. Development on land within or outside a SSSI, and which is likely to have an adverse effect on an it (either individually or in combination with	The landfall overlaps with the Lytham St. Annes dunes SSSI. All designated features of this SSSI are located above MHWS and are therefore assessed in Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES. Additionally, CoT44 (**Table 2.11**) sets out that the installation of the onshore export cable corridor at Lytham St Annes SSSI and the St Annes Old Link Golf Course will be undertaken by trenchless techniques, for example, direct pipe.

Summary of NPS provision	How and where considered in the ES
other developments), should not normally be permitted. The only exception is where the benefits (including need) of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of SSSIs. [Paragraphs 5.4.7-5.4.8]	Furthermore, trenchless installation techniques will also be used to cross the River Ribble where the 400 kV grid connection corridor is proposed (CoT90, **Table 2.11**), therefore avoiding impacts on the Ribble Estuary SSSI. Also, the Planning Statement (document reference J28) has assessed the impacts and benefits to designated sites.
MCZs (Marine Protected Areas in Scotland), introduced under the Marine and Coastal Access Act 2009, are areas that have been designated for the purpose of conserving marine flora or fauna, marine habitats or types of marine habitat or features of geological or geomorphological interest. The protected feature or features and the conservation objectives for the MCZ are stated in the designation order for the MCZ. If a proposal is likely to have significant impacts on an MCZ, an MCZ Assessment should be undertaken as per the requirements under section 126 of the Marine and Coastal Access Act 2009. [Paragraph 5.4.9]	All relevant nearby or overlapping MCZs have been identified in **section 2.6.2**, with the relevant qualifying features of these sites identified as Important Ecological Features (IEFs) and given specific consideration where relevant in the assessment of effects (**section 2.11**). Additionally, an MCZ Screening and Stage 1 Assessment Report (document reference: E4) has been undertaken to determine if a full MCZ assessment is required. The MCZ Screening and Stage 1 Assessment Report concluded that the Transmission Assets has the potential to affect the interest features of the Fylde MCZ and this site has been taken forward for a full MCZ Stage 1 Assessment (document reference: E4).
Where the development is subject to EIA, the Applicants should ensure that the ES clearly sets out any effects on internationally, nationally, and locally designated sites of ecological or geological conservation importance (including those outside England), on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity, including irreplaceable habitats. [Paragraph 5.4.17]	The Transmission Assets will aim to conserve habitats through a number of measures adopted to reduce the significance of potential effects associated with the Transmission Assets (**section 2.8**). Furthermore, **section 2.6.2** evaluates relevant designated sites in the Transmission Assets benthic subtidal and intertidal ecology study area and the rationale for which sites have been taken forward for assessment in **section 2.11**. The impact of the Transmission Assets on all European sites with relevant benthic habitats protected under the Habitats Regulations is assessed in the Habitats Regulation Assessment (HRA) Stage 1 Screening Report (document reference: E3) and the HRA Stage 2 Information to Support Appropriate Assessment (ISAA) Part 2 – SAC assessments (document reference E2.2).
The Applicants should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests. [Paragraph 5.4.19]	The Transmission Assets will aim to conserve habitats through a number of measures adopted as part of the Transmission Assets to reduce the magnitude of impacts (see **section 2.8**). The Marine enhancement Statement (document reference: J12) outlines the approach of the Transmission Assets to biodiversity enhancement.
Applicants should consider wider ecosystem services and benefits of natural capital when designing enhancement measures. [Paragraph 5.4.20]	The Marine enhancement Statement (document reference: J12) outlines the approach of the Transmission Assets to biodiversity enhancement.
The design process should embed opportunities for nature inclusive design. Energy infrastructure projects have the potential to deliver significant	The Marine enhancement Statement (document reference: J12) outlines the approach of the

<table>
<tr><th>Summary of NPS provision</th><th>How and where considered in the ES</th></tr>
<tr><td>benefits and enhancements beyond BNG, which result in wider environmental gains. The scope of potential gains will be dependent on the type, scale, and location of each project.

[Paragraph 5.4.21]</td><td>Transmission Assets to biodiversity enhancement.</td></tr>
<tr><td>Applicants should include appropriate avoidance, mitigation, compensation and enhancement measures as an integral part of the proposed development. The Applicants should demonstrate that:
• During construction, they will seek to ensure that activities will be confined to the minimum areas required for the works
• The timing of construction has been planned to avoid or limit disturbance
• During construction and operation best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised, including as a consequence of transport access arrangements
• Habitats will, where practicable, be restored after construction works have finished
• Opportunities will be taken to enhance existing habitats rather than replace them, and where practicable, create new habitats of value within the site landscaping proposals. Where habitat creation is required as mitigation, compensation, or enhancement the location and quality will be of key importance. In this regard habitat creation should be focused on areas where the most ecological and ecosystems benefits can be realised.
• Mitigations required as a result of legal protection of habitats or species will be complied with.

[Paragraph 5.4.35]</td><td>The Maximum Design Scenario (MDS) represents the parameters that make up the realistic worst case scenario. Parameters within this MDS which could have the worst case impact in relation to each specific receptor have been clearly set out and assessed within each topic chapter. For benthic subtidal and intertidal ecology, the assessment is presented in section 2.11 and the MDS is presented in Table 2.12. This approach allows for an assessment of the minimum area required to work for each activity.

Best practice during construction and maintenance will be set out in the Construction method statement (CMS) (CoT49, Table 2.11) and the Offshore Environmental management plan (EMP) (CoT65, Table 2.11).

Following the completion of most activities sedimentary habitats will recover naturally, typically on short term timescales, within one to three years, depending on species and habitat (further detail provided in sections 2.11.2 and 2.11.3) and measures have been adopted for the Transmission Assets to avoid direct impacts on sensitive habitats where recovery would be limited (section 2.8).

The Marine enhancement Statement (document reference: J12) outlines the approach of the Transmission Assets to biodiversity enhancement. The Transmission Assets will aim to conserve habitats through a number of measures adopted as part of the Transmission Assets to reduce the impact of the Transmission Assets (section 2.8).

Mitigation has been considered throughout section 2.11 and 2.13, however no additional mitigation has been considered relevant based on the conclusions reached for benthic subtidal and intertidal ecology beyond the embedded primary and tertiary mitigation measures adopted as part of the Transmission Assets, with the mitigation hierarchy also being followed to reduce and mitigate effects where possible (section 2.8). Full details on how these have been applied to reduce impacts on designated sites including the Fylde MCZ have been presented in the MCZ Assessment and Stage 1 Assessment Report (document reference: E4). Also, the project design parameters have been reduced through project refinement post-PEIR (Table 2.12).</td></tr>
<tr><td>Applicants should produce and implement a Biodiversity Management Strategy as part of</td><td>Measures adopted as part of the Transmission Assets have been outlined in section 2.8,</td></tr>
</table>

Summary of NPS provision	How and where considered in the ES
their development proposals. This could include provision for biodiversity awareness training to employees and contractors so as to avoid unnecessary adverse impacts on biodiversity during the construction and operation stages. [Paragraph 5.4.36]	including an Offshore EMP (CoT65, **Table 2.11**), which includes a Marine Pollution Contingency Plan (MPCP), a chemical risk review, measures to minimise the potential spread of INNS, and waste management and disposal arrangements.
As a general principle, and subject to the specific policies below, development should, in line with the mitigation hierarchy, aim to avoid significant harm to biodiversity and geological conservation interests, including through consideration of reasonable alternatives. Where significant harm cannot be avoided, impacts should be mitigated and as a last resort, appropriate compensation measures should be sought. [Paragraph 5.4.42]	Mitigation has been considered in **section 2.11** and **2.13**, however no additional mitigation has been considered relevant based on the conclusions reached for benthic subtidal and intertidal ecology beyond the measures adopted as part of the Transmission Assets, with the mitigation hierarchy also being followed to reduce and mitigate effects where possible (**section 2.8**). Full details on how these have been applied to reduce impacts on designated sites including the Fylde MCZ have been presented in the MCZ Assessment and Stage 1 Assessment Report (document reference: E4). Also, the design parameters have been reduced through project refinement post-PEIR (**Table 2.12**).
If significant harm to biodiversity resulting from a development cannot be avoided (for example through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then the Secretary of State will give significant weight to any residual harm. [Paragraph 5.4.43]	An assessment of significance was undertaken in **sections 2.11** and **2.13**, and no significant effects, in EIA terms, have been identified, therefore no additional mitigation or compensation has been proposed beyond the measures adopted as part of the Transmission Assets (**section 2.8**).
In taking decisions, the Secretary of State should ensure that appropriate weight is attached to designated sites of international, national and local importance; protected species; habitats and other species of principal importance for the conservation of biodiversity; and to biodiversity and geological interests within the wider environment. [Paragraph 5.4.48]	In accordance with best practice guidelines, for the purposes of the benthic subtidal and intertidal ecology EIA, IEFs have been identified (see **Table 2.9**). The IEFs assessed are those that are considered to be important and potentially affected by the Transmission Assets. Importance may be assigned due to quality or extent of habitats, habitat or species rarity or the extent to which they are threatened (Chartered Institute of Ecology and Environmental Management (CIEEM), 2022). Species and habitats are considered IEFs if they have a specific biodiversity importance recognised through international or national legislation or through local, regional, or national conservation plans (e.g. Annex I habitats under the Habitats Directive, Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR), National Biodiversity Plan or the Marine Strategy Framework Directive).
The ES should include an assessment of the effects on the coast, tidal rivers and estuaries. In particular, applicants should assess:	These impacts and effects have been considered by the inclusion of intertidal IEFs in each assessment, and specifically in the assessments of increased Suspended Sediment

Summary of NPS provision	How and where considered in the ES
• the effects of the proposed project on marine ecology, biodiversity, protected and heritage sites. [Paragraph 5.6.11]	Concentrations (SSC) and deposition in **sections 2.11.2** and **2.11.9**.
The applicant should be particularly careful to identify any effects of physical changes on the integrity and special features of Marine Protected Areas (MPAs). These could include MCZs, HRA Sites including SACs and SPAs with marine features, Ramsar Sites, Sites of Community Importance and SSSIs with marine features. [Paragraph 5.6.13]	All relevant designated sites within the Transmission Assets benthic subtidal and intertidal ecology study area (i.e. SACs, MCZs, SSSIs, Ramsar sites and Marine Nature Reserves (MNRs)) with relevant benthic features have been identified within Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES. The designated sites, and their relevant qualifying benthic features, that could be affected by the construction, operation and maintenance, or decommissioning of the Transmission Assets are identified in **section 2.6.2**. As a result of this process, the qualifying features of three MCZs have been considered in this assessment, with these identified in **section 2.6.2** and assessed throughout **section 2.11**. The impact of the Transmission Assets on European sites is assessed in the HRA Stage 1 Screening Report (document reference: E3) and the HRA Stage 2 ISAA (document reference E2.1, E2.2 and E2.3). Additionally, an MCZ Screening and Stage 1 Assessment Report (document reference: E4) has been undertaken to determine if a full MCZ assessment is required. The MCZ Screening and Stage 1 Assessment Report concluded that the Transmission Assets has the potential to affect the interest features of the Fylde MCZ and this site was taken forward for a full Stage 1 Assessment within the same report (document reference: E4).
NPS EN-3	
Given the scale of offshore wind deployment required to meet 2030 and 2050 ambitions, applicants will need to give close consideration to impacts on MPAs, either alone or in combination, and employ the mitigation hierarchy, and if necessary, provide compensation (both individually and in combination with other plans or projects) which may be needed to approve their projects. It is likely that mitigation may include proactive measures to reduce the impact of deployment e.g., micrositing of offshore transmission routes to avoid vulnerable habitats, alternatives piling or trenching techniques, noise abatement technology, collision avoidance methods, or if necessary, compensation for habitat loss. [Paragraphs 2.8.52-53]	All designated sites with relevant benthic ecology features which have the potential to be impacted by the Transmission Assets as well as protected habitats and species within the benthic subtidal and intertidal ecology study area have been identified as IEFs (see **section 2.6.5**) and considered in the assessment where relevant in **section 2.6.2**. The HRA Stage 1 Screening report (document reference: E3) identifies direct or indirect effects on European sites which could be affected, and those sites have been assessed in the HRA Stage 2 ISAA (document reference: E2.1, E2.2 and E2.3). The HRA Stage 1 ISAA concludes that there will be no adverse effect on integrity of any European site as a result of the Transmission Assets alone or in-combination with other projects. The MCZ Screening and Stage 1 Assessment Report (document reference: E4) identified a

Summary of NPS provision	How and where considered in the ES
	single MCZ, the Fylde MCZ, with the potential to be affected (other than insignificantly) by the construction, operation and maintenance, and decommissioning of the Transmission Assets. An MCZ Screening and Stage 1 Assessment has been undertaken which has concluded that the conservation objective of maintaining the protected features of the Fylde MCZ in a favourable condition will not be hindered by the construction, operation and maintenance, and decommissioning phases of the Transmission Assets in isolation, or cumulatively with any other plan, project or activity.
As part of the Offshore Wind Environmental Improvement Package set out in the British Energy Security Strategy, government committed to establishing Offshore Wind Environmental Standards (OWES; previously referred to as Nature Based Design Standards) to accelerate deployment whilst enhancing the marine environment. OWES aim to support developers to take a more consistent approach to avoiding, reducing, and mitigating the impacts of an offshore wind farms and/or offshore transmission infrastructure. The measures could apply to the design, construction, operation and decommissioning of offshore wind farms and offshore transmission. Defra will consult on a series of OWES before drafting clear OWES Guidance, which sets out where and how Defra expects each measure to be applied to a development. Once the OWES Guidance is issued, the Secretary of State will expect applicants to have applied the relevant measures to their applications. Applicants should explain how their proposals comply with the guidance or, alternatively, the grounds on which a departure from them is justified. Any reasons for departure from the OWES should be fully detailed within the application documents, with details of any agreements made with statutory consultees. [Paragraphs 2.8.90-92]	The Applicants are aware of the requirements in NPS EN-3 to apply the guidance on Environmental Standards once the final guidance is issued. The Applicants will review the guidance once available and determine how the Transmission Assets complies with the guidance, and where, if relevant, the Transmission Assets departs from it.
Any relevant data that has been collected as part of post-construction ecological monitoring from existing operational offshore wind farms should be referred to where appropriate. [Paragraph 2.8.106]	Relevant data collected as part of post-construction monitoring from other offshore wind farms has informed the baseline presented in **section 2.6**, with full details provided in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
Assessments should also include effects such as the scouring that may result from the proposed development and how that might impact sensitive species and habitats [Paragraph 2.8.113]	The effect of primary scour to the seabed as a result of the Transmission Assets has been scoped out of the assessment as detailed in **section 2.7**. The only infrastructure capable of resulting in scour under the scope of the Transmission Assets relates to that of cable protection. However, cable protection measures

Summary of NPS provision	How and where considered in the ES
	will be subject to engineering design to ensure they minimise as much as practical the occurrence of scour, to such a degree that it will not impact upon seabed morphology. Secondary scour has been considered within the project alone assessment and Cumulative Effects Assessment (CEA) of the ES, within **section 2.11** and **section 2.13**.
Applicant assessment of the effects of installing offshore transmission infrastructure across the intertidal/coastal zone should demonstrate compliance with mitigation measures in any relevant plan-level HRA including those prepared by The Crown Estate as part of its leasing round, and include information, where relevant, about: • any alternative landfall sites that have been considered by the applicant during the design phase and an explanation for the final choice; • any alternative cable installation methods that have been considered by the applicant during the design phase and an explanation for the final choice; • potential loss of habitat; • disturbance during cable installation, maintenance/repairs and removal (decommissioning); • increased suspended sediment loads in the intertidal zone during installation and maintenance/repairs; • potential risk from invasive and non-native species (INNS); • predicted rates at which the intertidal zone might recover from temporary effects, based on existing monitoring data; and • protected sites [Paragraph 2.8.119]	There are no relevant mitigation measures in the plan-level HRA that require consideration in this assessment (The Crown Estate, 2020). The MDS for export cable installation at the landfall has been considered throughout the assessment. This ensures that a reasonable assessment of the effects of the various impacts associated with this method are presented. Alternative landfall routes were considered during the site selection process during scoping, and are outlined in Volume 1, Chapter 4: Site selection and consideration of alternatives of the ES and Volume 1, Annex 4.2: Selection of Grid Connection and Refinement of Offshore Infrastructure of the ES. A description of the activities which could result in habitat disturbance from cable installation and maintenance and increased suspended sediments has been provided in the MDS (**Table 2.12**). The predicted rates of recovery in the intertidal zone from temporary effects has been considered in the sensitivity of the intertidal biotopes and then used to determine the final significance of an impact (**section 2.11**). The impacts of cable installation are much reduced following the commitment to cable installation mitigation measures (CoT47, **Table 2.11**), and the reduction in other parameters (including sandwave clearance and cable protection parameters (CoT47, **Table 2.11**)). This update to the project design parameters was made following stakeholder feedback, and review of further site specific data. Habitat loss has been assessed in **section 2.11.5**, while impacts associated INNS are assessed in **section 2.11.7**. Values for the potential habitat loss, disturbance from cable installation and maintenance and increased suspended sediments have been considered and quantified in the MDS (**Table 2.12**). Sites of conservation importance which may be directly or indirectly affected by the Transmission Assets have been identified in **section 2.6.2** and the relevant benthic features assessed in **sections 2.11** and **2.13**. The impacts (e.g. from sandwave clearance and placement of cable protection) upon sites of conservation importance which overlap with the Transmission Assets have

Summary of NPS provision	How and where considered in the ES
	been greatly reduced following refinement to the project design parameters post- Preliminary Environmental Information Report (PEIR), as discussed in **Table 2.12** and in the magnitude section of each impact where relevant. This update to the project design parameters was made following stakeholder feedback, and review of further site specific data.
Applicant assessment of the effects on the subtidal environment should include: • Loss of habitat due to foundation type including associated seabed preparation, predicted scour, scour protection and altered sedimentary processes, (e.g. sandwave/boulder/Unexploded Ordnance (UXO) clearance); • Environmental appraisal of inter-array and other offshore transmission and installation/maintenance methods, including predicted loss of habitat due to predicted scour and scour/cable protection, and sandwave/boulder/UXO clearance; • Habitat disturbance from construction and maintenance/repair vessels' extendible legs and anchors; • Increased suspended sediment loads during construction and from maintenance/repairs; • Predicted rates at which the subtidal zone might recover from temporary effects; • Potential impacts from Electromagnetic Fields (EMF) on benthic fauna; • Potential impacts upon natural ecosystem functioning; • Protected sites; and • Potential for invasive/non-native species introduction. [Paragraph 2.8.126]	The MDS for long term loss of habitat (see **section 2.11.5**) considers only the presence of cable protection for the offshore export cables, since all foundations, associated scour protection and interconnector cables were removed from the project design parameters post-PEIR. There are also no inter-array cables included in the project description for the Transmission Assets. The MDS for temporary habitat disturbance considers sandwave clearance, boulder clearance and UXO clearance (see **section 2.11.2)**. The impact of suspended sediments, long term habitat loss, EMF from subsea cables, the introduction and spread of INNS and temporary habitat disturbance from cable installation and maintenance as well as anchors and vessel legs (i.e. jack-up legs) has been quantified in the MDS (**Table 2.12**). The effect of these impacts on the habitats within the Transmission Assets has then been assessed regarding the Transmission Assets alone throughout **section 2.11** and cumulatively with other relevant projects in the region in **section 2.13**. The predicted rates of recovery in the subtidal zone from temporary effects has been considered in the sensitivity of the subtidal biotopes and then used to determine the final significance of an impact (**section 2.11**).Relevant data collected as part of post-construction monitoring from other offshore wind farms has informed the assessment based presented in **section 2.6**, which is a summary of the full baseline characterisation presented in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology of the ES.
Landfall and cable installation and decommissioning methods should be designed appropriately to minimise effects on intertidal/coastal habitats, taking into account other constraints. Where applicable, use of HDD should be considered as a method to avoid impacts on sensitive habitats and species. [Paragraph 2.8.227-228]	The methods of cable installation and decommissioning and a quantification of the associated impacts on benthic receptors is presented in the MDS in **Table 2.12**. The Applicants are committed to development of and adherence to an Outline Offshore Cable specification and installation plan (CSIP) (CoT45, **Table 2.11**) (document reference J15). This will minimise the impacts to all benthic intertidal receptors. CoT19 (**Table 2.11**) highlights the Applicants commitment to using non-impact methods for all trenchless crossings to minimise the impact of construction beyond the immediate location of work. Further details regarding export

Summary of NPS provision	How and where considered in the ES
	cable installation methods are included in Volume 1, Chapter 3: Project description of the ES.
Where cumulative effects on intertidal habitats are predicted as a result of the cumulative impact of multiple cable routes, applicants of various schemes are encouraged to work together to ensure that the number of cables crossing the intertidal/coastal zone are minimised, and installation and decommissioning phases are coordinated to ensure that disturbance is also reasonably minimised. [Paragraph 2.8.231]	As outlined in **section 2.12.1**, the CEA has been undertaken to take into account the impact associated with the Transmission Assets together with other projects and plans. The cumulative assessment has been undertaken to specifically consider the Transmission Assets together with the Morecambe Offshore Windfarm: Generation Assets (Scenario 1), the Transmission Assets together with Morgan Offshore Wind Project: Generation Assets (Scenario 2) and the Transmission Assets together with both the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets (Scenario 3). This assessment has been undertaken before the cumulative assessment for the other Tier 1-3 developments. No significant cumulative effects on benthic intertidal receptors are predicted for any of the cumulative scenarios.
Applicants should design construction, maintenance and decommissioning methods appropriately to minimise effects on subtidal habitats, taking into account other constraints. Mitigation measures with applicants are expected to have considered include: • surveying and micrositing of the turbines, designing array layout, or re-routing of the export and inter-array cables to avoid adverse effects on sensitive/protected habitats, biogenic reefs or protected species; • reducing as much as possible the amount of infrastructure that will cause habitat loss in sensitive/protected habitats; • burying cables at a sufficient depth, taking into account other constraints, to allow the seabed to recover to its natural state; and • the use of anti-fouling paint could be minimised on subtidal surfaces in certain environments, to encourage species' colonisation on the structures, unless this is within a soft sediment MPA and thus would allow colonisation by species that would not normally be present. [Paragraph 2.8.233-234]	Details regarding surveys and micrositing associated with turbines, or routing of inter-array and inter-connector cables have not been included as they are not part of the project description for the Transmission Assets. This has been assessed as part of the respective DCO applications for the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. The measures adopted as part of the Transmission Assets (defined in **section 2.8**) to reduce the potential for impacts on benthic subtidal and intertidal ecology have been outlined in **Table 2.11**. These include development of and adherence to an Outline Offshore CSIP (document reference J15) (CoT45, **Table 2.11**) and an Outline Cable burial risk assessment (CBRA) (document reference J14). The Outline Offshore CSIP (document reference J15) includes measures to limit the extent of cable protection and sandwave clearance within the Fylde MCZ (CoT45, **Table 2.11**) and will be informed through the undertaking of survey works pre-construction. The impacts of the construction, operation and maintenance, and decommissioning phases of the Transmission Assets are planned to be mitigated using the measures identified in **section 2.8**. The Transmission Assets alone assessment MDS includes the impact of cable crossings where relevant (**Table 2.12**). Cumulative effects have been quantified and their significance assessed in **section 2.13** including the impact of cables from other projects within the benthic subtidal and intertidal ecology CEA study area. There are no

Summary of NPS provision	How and where considered in the ES
	other cables routes which overlap with the landfall and significant cumulative (or alone) effects are not predicted on intertidal or subtidal receptors. Additionally, the use of anti-fouling paint is not included in the project description for the Transmission Assets due to the offshore export cables being largely buried.
Where cumulative impacts on subtidal habitats are predicted as a result of multiple cable routes, applicants for various schemes are encouraged to work together to ensure that the number of cables crossing the subtidal zone is minimised and installation/decommissioning phases are coordinated to ensure that disturbance is reasonably minimised. [Paragraph 2.8.235]	As outlined in Volume 1, Chapter 3: Project description of the ES, the Transmission Assets is a coordinated application for the export cables associated with the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Wind Farm: Generation Assets. The transmission infrastructure for each wind farm will remain electrically independent (i.e., each wind farm to have its own sets of cabling and substation infrastructure as detailed in the MDS; see **Table 2.12**). However, the infrastructure has been locationally aligned within offshore and onshore cable corridors (where practicable) to minimise impacts to the environment.
The Secretary of State should be satisfied that activities have been designed considering sensitive subtidal environmental aspects, and discussions with the relevant conservation bodies have taken place. [Paragraph 2.8.317]	The effect of impacts related to the design of the Transmission Assets have been assessed in **section 2.11**. This included the consideration of the sensitivity of the relevant subtidal habitats and the consideration of mitigation where necessary. A number of commitments have been made by the Applicant (**Table 2.11**) to reduce the impact of the Transmission Assets on benthic receptors, these include commitments within the Outline Offshore CSIP (document reference J15) as informed by the Outline CBRA (document reference J14), to minimise cable protection and sandwave clearance in the Fylde MCZ (CoT47) and a commitment to ensure that all external cable protection used within the Fylde MCZ will be designed to be removable on decommissioning (CoT108). The Applicant has also committed to the development of an Offshore EMP which will include an MPCP, chemical risk review and measures to minimise spread of INNS (CoT65). An evidence plan has been set up with the statutory nature conservation bodies (SNCBs) and other consultees to consult on the Transmission Assets on topics such as sensitive subtidal environmental aspects (see **section 2.3**). As part of this process an expert working group (EWG) for benthic ecology, physical processes and fish and shellfish ecology was established to facilitate this consultation.
Applicants should assess the potential for their proposed development to have net positive effects on marine ecology and biodiversity as well as negative effects.	The alone assessment presented in **section 2.11** and the cumulative assessment in **section 2.13** have considered both the positive and negative effects of the Transmission Assets on marine

Summary of NPS provision	How and where considered in the ES
[Paragraph 2.11.40]	ecology and biodiversity. The Marine enhancement Statement (document reference J12) outlines the approach of the Transmission Assets to biodiversity enhancement.

Marine policy

UK Marine Policy Statement

2.2.2.6 The assessment of potential changes to benthic subtidal and intertidal ecology has also been made with consideration to the specific policies set out in the UK Marine Policy Statement (HM Government, 2011). **Table 2.2** sets out a summary of the specific policies set out in the UK Marine Policy Statement (HM Government, 2011) relevant to this chapter.

Table 2.2: Summary of the UK Marine Policy Statement relevant to this chapter

Topic	Key provisions	How and where considered in the ES
Marine ecology and biodiversity – biodiversity protection	Biodiversity is protected, conserved and where appropriate recovered and loss has been halted.	The assessment of benthic subtidal and intertidal habitats has been undertaken considering the MDS to ensure that a realistic 'worst case' scenario is assessed and that there is no over estimation of the scope of the project in regard to its impact on biodiversity. The Marine Enhancement Statement (document reference J12) outlines the approach of the Transmission Assets to biodiversity enhancement.
Marine ecology and biodiversity – habitat health	Healthy marine and coastal habitats occur across their natural range and are able to support strong, biodiverse biological communities and the functioning of healthy, resilient and adaptable marine ecosystems.	This assessment of benthic subtidal and intertidal habitats considers the sensitivity of the habitats identified to the impacts associated with the Transmission Assets, including factor such as the resilience of a habitat. The methodology for determining the sensitivity of a habitat is outlined in **section 2.10.2**.
Marine ecology and biodiversity – vulnerable species	Our oceans support viable populations of representative, rare, vulnerable, and valued species.	As part of the characterisation of the Transmission Assets site-specific survey area species and habitats of conservation importance were identified, these habitats and species are highlighted in **section 2.6.5** and assessed in **section 2.11**. The full characterisation of the Offshore Order Limits can be found in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
Marine ecology and biodiversity – beneficial features	It is also recognised that the benefits of development may include benefits for marine ecology, biodiversity and geological conservation interests and	The introduction of artificial substrates and the potential benefits for marine ecology and biodiversity are discussed in **section 2.11.6.** The Marine

Topic	Key provisions	How and where considered in the ES
	that these may outweigh potential adverse effects. Development proposals may provide, where appropriate, opportunities for building-in beneficial features for marine ecology, biodiversity and geodiversity as part of good design; for example, incorporating use of shelter for juvenile fish alongside proposals for structures in the sea. When developing Marine Plans, marine plan authorities should maximise the opportunities for integrating policy outcomes.	Enhancement Statement (document reference J12) outlines the approach of the Transmission Assets to biodiversity enhancement.
Marine ecology and biodiversity – designated sites and protected species	The marine plan authority should ensure that appropriate weight is attached to designated sites; to protected species; habitats and other species of principal importance for the conservation of biodiversity; and to geological interests within the wider environment. Many individual wildlife species receive statutory protection under a range of legislative provisions. Other species and habitats have been identified as being of principal importance for the conservation of biodiversity in the UK and thereby requiring conservation action or are subject to recommended conservation actions by an appropriate international organisation. Priority marine features are being defined in the seas around Scotland. The marine plan authority should ensure that development does not result in a significant adverse effect on the conservation of habitats or the populations of species of conservation concern and that wildlife species and habitats enjoying statutory protection are protected from the adverse effects of development in accordance with applicable legislation.	Designated sites and the associated qualifying features relevant to benthic subtidal and intertidal ecology have been identified in **Table 2.7** and, along with other protection status, conservation actions and legislations, have been used to defined IEFs as key receptors to take forward in the assessment (**Table 2.8**).
Ecological and chemical water quality and resources	Developments and other activities at the coast and at sea can have adverse effects on transitional waters, coastal waters and marine waters. During the construction, operation and decommissioning phases of developments, there can be increased demand for water, discharges to water and adverse ecological effects resulting from physical modifications to the water environment. There may also be an increased risk of spills and leaks of pollutants into the water environment	The potential for the release of sediment bound contaminants in all phases has been assessed in **section 2.11.4.** The potential impact of accidental pollution in all phases of the Transmission Assets has been scoped out of this assessment (**Table 2.10**) due to the low risk posed by this impact as a result of measures adopted by the project which include set out in standard post-consent plans (Outline Offshore EMP (for application, CoT65, **Table 2.11**), including a MPCP).

Topic	Key provisions	How and where considered in the ES
	and the likelihood of transmission of invasive non-native species, for example through construction equipment, and their impacts on ecological water quality need to be considered.	
Marine protected areas	Marine plan authorities and decision makers should take account of how developments will impact on the aim to halt biodiversity loss and the legal obligations relating to all MPAs, their conservation objectives, and their management arrangements. Marine plan authorities and decision-makers should take account of the regime for MPAs and comply with obligations imposed in respect of them. This includes the obligation to ensure that the exercise of certain functions contribute to, or at least do not hinder, the achievement of the objectives of a MCZ or MPA (in Scotland). This would also include the obligations in relevant legislation relating to SSSIs and sites designated under the Wild Birds and Habitats Directives.	The designated sites with benthic subtidal and intertidal ecology features within the Transmission Assets benthic subtidal and intertidal ecology study area have been identified in **section 2.6.2**. The European sites which could potentially be impacted by the Transmission Assets are also identified in the HRA Stage 1 Screening Report (document reference E3). The MCZs with the potential to be impacted by the Transmission Assets have been assessed throughout this report in **sections 2.11** and **2.13**.
Renewable energy - introduction of artificial reef structures	As yet, the potential for benefits such as introduction of artificial reef structures, which can yield biodiversity benefits and fishing opportunities around wind farm sites, have not been fully explored. These should be considered further in the context of marine planning and for individual developments.	The introduction of artificial substrates and the potential benefits for benthic subtidal ecology are discussed in **section 2.11.6**. The Marine Enhancement Statement (document reference J12) outlines the approach of the Transmission Assets to biodiversity enhancement.
Renewable energy – Offshore Electricity Networks	An increase in underwater cables in the UK marine area will cause environmental impacts. Impacts from cable installations on the sea bed are low and mainly occur due to the physical disturbance involved with their placement. They tend to be of short duration with a relatively small area being affected. The main impact will be where cable protection, for example rock armour or concrete mattresses, is required where cable burial is not feasible. This is particularly the case where cables either run through, or have landfall within, any site designated as being of national or international nature conservation importance or other sensitive areas such as designated shell fisheries, spawning or nursery grounds for	The impacts of underwater cables (i.e., EMF, habitat loss/disturbance, introduction of hard substrata) on benthic subtidal and intertidal ecology have been identified in the key parameters for assessment (**section 2.7**) and assessed in the assessment of significant effects (**sections 2.11.10**).

Topic	Key provisions	How and where considered in the ES
	economically important fish species or marine archaeological sites.	

North West Inshore and North West Offshore Marine Plans 2021

2.2.2.7 **Table 2.3** sets out a summary of the specific policies set out in the North West Inshore and North West Offshore Coast Marine Plan (HM Government, 2021) relevant to this chapter.

2.2.2.8 A National Policy Statement Tracker (document reference J26) and Planning Statement (document reference J28) has been submitted alongside the application which collates compliance with relevant marine plans.

Table 2.3: Summary of inshore and offshore marine plan policies relevant to this chapter

Policy	Key provisions	How and where considered in the ES
NW-MPA-1	Proposals that support the objectives of marine protected areas and the ecological coherence of the marine protected area network will be supported. Proposals that may have adverse impacts on the objectives of marine protected areas must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate - adverse impacts, with due regard given to statutory advice on an ecologically coherent network.	As part of this chapter, designated sites within the study area have been identified (**section 2.6.2**). This has ensured that all habitats, features and species of conservation importance have been considered, where relevant, in this assessment. The mitigation hierarchy has also been followed to reduce and mitigate effects where possible (**section 2.8**). Full details on how these have been applied to reduce impacts on designated sites including the Fylde MCZ have been presented in the MCZ Assessment and Stage 1 Assessment Report (document reference: E4). Also, to further reduce potential impacts, the project design parameters have been reduced through project refinement post-PEIR (**Table 2.12**).
NW-BIO-1	NW-BIO-1 encourages and supports proposals that enhance the distribution of priority habitats and priority species. Proposals that may have significant adverse impacts on the distribution of priority habitats and priority species must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate - adverse impacts so they are no longer significant d) compensate for significant adverse impacts that cannot be mitigated.	The Marine enhancement Statement (document reference: J12) outlines the approach of the Transmission Assets to biodiversity enhancement. The Transmission Assets will minimise potential impacts on priority habitat features through a number of measures adopted to reduce the impact of the introduced infrastructure (**section 2.8**). The mitigation hierarchy has also been followed to reduce and mitigate effects on designated sites where possible (**section 2.8**).

Policy	Key provisions	How and where considered in the ES
NW-BIO-2	NW-BIO-2 requires proposals to manage negative effects which may significantly adversely impact the functioning of healthy, resilient and adaptable marine ecosystems. Proposals that may cause significant adverse impacts on native species or habitat adaptation or connectivity, or native species migration, must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate - adverse impacts so they are no longer significant d) compensate for significant adverse impacts that cannot be mitigated.	Mitigation is considered where the significance of an impact is moderate or major to reduce the significance of the impact to negligible or minor. This assessment has been undertaken for each impact (**section 2.11**). The mitigation hierarchy has also been followed to reduce and mitigate effects on designated sites where possible (**section 2.8**). No significant adverse impacts have been identified within the Transmission Assets alone assessment (**section 2.11**) and CEA (**section 2.13**).
NW-BIO-3	Proposals that conserve, restore or enhance coastal habitats, where important in their own right and/or for ecosystem functioning and provision of ecosystem services, will be supported. Proposals must take account of the space required for coastal habitats, where important in their own right and/or for ecosystem functioning and provision of ecosystem services, and demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate d) compensate for – net habitat loss.	**Section 2.11** considers the magnitude, sensitivity and significance of the impacts associated with the Transmission Assets on the relevant subtidal and intertidal IEFs. Mitigation is considered where impacts were found to be significant. As a result, the Transmission Assets seeks to conserve the function and services provided by coastal habitats. The mitigation hierarchy has also been followed to reduce and mitigate effects on designated sites where possible (**section 2.8**).

Policy	Key provisions	How and where considered in the ES
NW-INNS-1	NW-INNS-1 aims to avoid or minimise damage to the marine area from the introduction or transport of invasive non-native species. Proposals must put in place appropriate measures to avoid or minimise significant adverse impacts that would arise through the introduction and transport of invasive non-native species, particularly when: 1) moving equipment, boats or livestock (for example fish or shellfish) from one water body to another 2) introducing structures suitable for settlement of invasive non-native species, or the spread of invasive non-native species known to exist in the area.	The implementation of an Offshore EMP (CoT65, **Table 2.11**) as part of the measures adopted by the Transmission Assets (**section 2.8**) will minimise the potential spread of INNS (CoT65, **Table 2.11**). The mitigation hierarchy has also been followed to reduce and mitigate effects on designated sites where possible (**section 2.8**).
NW-CE-1	Proposals which may have adverse cumulative effects with other existing, authorised, or reasonably foreseeable proposals must demonstrate that they will avoid, minimise and mitigate.	Cumulative effects have been quantified and their significance assessed in **section 2.12**. This section includes the consideration of mitigation where the significance is found to be moderate or major.

2.2.3 Relevant guidance

2.2.3.1 The benthic subtidal and intertidal ecology impact assessment has followed the methodology set out in Volume 1, Chapter 5: Environmental assessment methodology of the ES. Specific to the benthic subtidal and intertidal ecology impact assessment, the following guidance documents have also been considered.

- Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater and Coastal (CIEEM, 2022).
- Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR), 2008).
- Identification of the Main Characteristics of Stony Reef Habitats under the Habitats Directive (Irving, 2009; Golding, 2020).
- Marine Evidence-based Sensitivity Assessment – A Guide (Tyler-Walters *et al*., 2018).
- Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects (Judd, 2012).
- Nature Conservation Considerations and Environmental Best Practice for Subsea Cables for English Inshore and UK Offshore

Waters (Natural England and the Joint Nature Conservation Committee (JNCC), 2022).

2.3 Consultation

2.3.1 Scoping

2.3.1.1 On 28 October 2022, the Applicants submitted a Scoping Report to the Planning Inspectorate, which described the scope and methodology for the technical studies being undertaken to provide an assessment of any likely significant effects for the construction, operation and maintenance, and decommissioning phases of the Transmission Assets.

2.3.1.2 Following consultation with the appropriate statutory bodies, the Planning Inspectorate (on behalf of the Secretary of State) provided a Scoping Opinion on 8 December 2022.

2.3.2 Evidence plan process

2.3.2.1 Following scoping, consultation and engagement with interested parties specific to benthic subtidal and intertidal ecology has continued. An Evidence Plan Process (EPP) was developed for the Transmission Assets, seeking to ensure engagement with the relevant aspects of the EIA process throughout the pre-application phase. The development and monitoring of the Evidence Plan and its subsequent progress was undertaken by the EPP Steering Group. The Steering Group comprises the Planning Inspectorate, the Applicants, the Marine Management Organisation (MMO), Natural England, Historic England, the Environment Agency and the Local Planning Authorities as the key regulatory and bodies.

2.3.2.2 As part of the EPP, EWGs were set up to discuss and agree topic specific issues with the relevant stakeholders.

2.3.2.3 A benthic ecology, fish and shellfish and physical processes EWG was established with the SNCBs which includes representatives from the MMO, The Centre for Environment Fisheries and Aquaculture Science (Cefas), the Environment Agency, Natural England, The North West Wildlife Trust, JNCC and the North Western Inshore Fisheries and Conservation Authority. Discussion to date regarding benthic ecology with consultees via the benthic ecology, fish and shellfish and physical process EWG has focussed on providing consultees with information on the benthic subtidal and intertidal surveys within the Transmission Assets which were undertaken in 2022 and the proposed approach to the assessment as presented in **Table 2.4.**

2.3.3 Statutory consultation responses

2.3.3.1 The preliminary findings of the EIA consultation process were published in the PEIR in October 2023. The PEIR was prepared to provide the basis for formal consultation under the Planning Act 2008. This included consultation with statutory and non-statutory bodies under section 42 and 47 of the Planning Act 2008 as presented in **Table 2.4**.

2.3.4 Summary of consultation responses received

2.3.4.1 A summary of the key items raised specific to benthic subtidal and intertidal ecology is presented in **Table 2.4**, together with how these have been considered in the production of this chapter. It should however be noted that formal responses are provided for **all** consultation responses received and can be accessed in the Consultation Report (document reference E1).

Table 2.4: Summary of key consultation comments raised during consultation activities undertaken for the Transmission Assets relevant to benthic subtidal and intertidal ecology

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
April 2022	JNCC – Benthic Survey Scope of Works Report Response	The JNCC would request that, on all figures where relevant, the boundary between English and Welsh waters is represented along with the 12 nm limit to allow Statutory Nature Conservation Bodies to clearly identify areas within their remit.	The boundary between English and Welsh waters has been included on all figures in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES as requested.
		The West of Copeland MCZ does not currently have conservation advice specifically available; this should be incorporated when available, or appropriate proxy sites should be used in evaluations based on MPAs proxy guidelines in development.	Details of the West of Copeland MCZ features have been included in **section 1.3.4** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES, with the relevant designated features carried forward as IEFs in **Table 1.16** in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES for the assessment of potential impacts in the Environmental Statement. This site is considered in the MCZ Screening and Stage 1 Assessment Report (document reference E4).
	Natural England – Benthic Survey Scope of Works Report Response	Natural England advises that the Intertidal Phase I Walkover Survey be set out in a report, reflecting full details once determined (i.e. location), reflecting any desk-based studies and fully referenced. Natural England broadly agree with the survey methodology proposed.	The full results of the intertidal Phase I walkover survey are presented in **section 1.4.3** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		Sampling stations should be representative of the habitats present, with increased sampling where habitats differ from expectations. Particular attention should be given to habitat transitions to best understand the full area.	Sampling locations followed the approved sampling strategy, which was designed to be appropriately representative of expected habitats within the Transmission Assets. The results of this are outlined in **section 1.4.2** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES, with the overall distribution of habitats derived from these results presented in **Figure 1.21** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
	Natural Resources Wales (NRW) Advisory NRW (A) – Benthic Survey Scope of Works Report Response	NRW Advisory (A) agree in general with the sampling strategy that has been proposed.	The subtidal survey was conducted according to the sampling strategy and the results are presented in **section 1.4.2** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		In general, NRW (A) advise a minimum of one sample station per broadscale habitat (European Nature Information System (EUNIS) L3/L4), and where the indicative habitat areas are extensive, the minimum number of sample stations per habitat type should be increased accordingly to provide sufficient coverage of that habitat type.	The approved sampling strategy was used to characterise the infaunal and epifaunal biotopes present within the survey area to an appropriate level of detail, with results presented in **section 1.4.2** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		If sensitive or designated features, such as biogenic reefs, are discovered during grab sampling, replicate samples should be taken at least 50 m or an appropriate safe distance from the sensitive habitat.	Recommendations on the sampling strategy were incorporated into the survey methodology prior to survey commencement, with these details presented in **section 1.4.1** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		When sampling the export cable route, the proposed 2 km spacing between stations is broadly accepted, but nearshore and intertidal areas should be more heavily sampled for greater data resolution.	Recommendations on the sampling strategy were incorporated into the survey methodology prior to survey commencement, with these details presented in **section 1.4.1** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		If *Sabellaria spinulosa* reef (CR.MCR.CSab.Sspi) is found during grab sampling, photographs, measurement, and samples should be taken and compared to standard guidelines for determination of reef condition and quality.	No *S. spinulosa* reef or individuals were recorded within the survey area, as noted in the habitats assessment in **section 1.4.2** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		NRW advise that sediment samples are analysed to determine percentage of fines <63 microns (silt and clay) if the sediment	Recommendations on the sampling strategy were incorporated into the survey methodology prior to survey commencement, with these details presented in

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		sample and drop-down camera photos indicate the presence of fines.	**section 1.4.1** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		NRW (A) welcome the use of DNA metabarcoding techniques alongside traditional macrofauna analysis.	The results of the eDNA and DNA metabarcoding analysis are presented in **Appendix C.9** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		NRW (A) are content with the approach for the Intertidal Phase 1 Walkover Survey outlined separately in the Morgan Mona 2022 Benthic Ecology Survey Scope of Works advice request email received.	The full results of the intertidal Phase I walkover survey are set out in **section 1.4.3** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		The recommended physio-chemical analysis process for contaminant identification is acceptable in accordance with North East Atlantic Marine Biological Analytical Quality Control (NMBAQC) methods, and NRW further recommends that all results are compared to Cefas Action Levels (ALs).	All sediment chemistry samples have been compared against the relevant Cefas Action Level 1 (AL1) and Action Level 2 (AL2), the Canadian Threshold Effect Level (TEL) and Probable Effect Level (PEL), and the Effects Range Low (ERL) and Effects Range Median (ERM) thresholds where these exist for the various determinants. The results of these analyses are presented in **section 1.4.2** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		Whilst NRW (A) agree with the sampling for the offshore section, NRW (A) would advise a higher frequency of chemical sampling nearshore (i.e. every 2 km, as opposed to the recommended 5 km spacing) where the chance of sediment contamination is greater.	Recommendations on the sampling strategy were incorporated into the survey methodology prior to survey commencement, with these details presented in **section 1.4.1** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
December 2022	Environment Agency – Scoping Opinion	Biodiversity Net Gain will be required for this project. The project should consider where habitat improvements can be achieved as part of the scheme. We would expect to see this information provided in the ES.	Currently BNG only applies to terrestrial and intertidal components of projects. Principles for Marine Net Gain are currently in development by Defra who will provide guidance in due course (DESNZ, 2023a). There will be no long term habitat loss in the intertidal area as a result of the Transmission Assets and all impacts are predicted to be temporary and reversible. The metric for BNG allows for temporary losses to be disregarded when the original baseline habitat will be

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			restored to the same or better condition within two years of the loss. On this basis, BNG is considered unlikely to be required for intertidal habitats. The Marine enhancement Statement (document reference: J12) outlines the approach of the Transmission Assets to biodiversity enhancement.
	Isle of Man Department of Infrastructure – Scoping Opinion	Marine Nature Reserves and any other designated marine sites within the Isle of Man territorial sea should be given consideration.	All designated sites, including MNRs within the study area are identified in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES. The designated sites, and their relevant qualifying benthic features, that could be affected by the construction, operation and maintenance, and decommissioning of the Transmission Assets (i.e. that fall within the potential zone of influence (ZOI) of the Transmission Assets), are detailed in **section 2.6.2**. The MNRs around the Isle of Man are outside the ZOI and so will not be affected by the Transmission Assets. These sites have, therefore, not been considered further in this chapter.
		Species and habitats protected under Manx law (Wildlife Act 1990) or identified as threatened or declining by OSPAR should be given consideration in the assessment of direct and cumulative effects.	The Wildlife Act 1990 species list and requirements have been considered, and no specific overlap has been identified, as relevant, in the valuation of IEFs in **Table 2.8**. It should be noted, however, that the Isle of Man MNRs are outside the ZOI of the Transmission Assets and so are not considered further in this chapter.
		An Agreement for Lease with Orsted for an offshore wind farm within Isle of Man territorial waters should be included in relevant maps.	All relevant plans and projects, including the Mooir Vannin Offshore Wind Farm and the Mooir Vannin - UK Transmission Assets, have been included in the CEA in **section 2.13** in accordance with the CEA methodology detailed in **section 2.12**.
		In all relevant figures, inclusion of the Isle of Man territorial boundary would provide clarity on legislative requirements and benthic ecological connectivity.	The Isle of Man territorial waters boundary has been included in all relevant figures, specifically Figure 2.1 (see Volume 2, Figures).
		Limited evidence on the impacts of electromagnetic fields on commercially important benthic invertebrates does not indicate a lack of impact. Therefore,	The impacts of EMF on benthic receptors are assessed in **section 2.11.10** with reference to the most up to date literature available. An assessment of EMF effects on mobile and commercial important shellfish is presented in Volume 2, Chapter 3: Fish and shellfish ecology of the ES.

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		clarification is required on how this impact will be fully and appropriately assessed.	
	MMO – Scoping Opinion	The MMO recommend that micro-siting of transmission assets is considered where protected species or habitat features are otherwise negatively impacted, particularly within conservation designation areas.	No protected species or habitats were recorded in the site-specific surveys within the Transmission Assets Offshore Order Limits (hereafter referred to as the Offshore Order Limits) (**section 2.6.3** – habitats assessment). Therefore, micro-siting around any protected species or habitat features is not considered to be necessary. Further details on site selection are provided in Volume 1, Chapter 4: Site selection and consideration of alternatives of the ES.
		The MMO recommend options for compensatory measures where cables bisect designated areas such as the Fylde MCZ and Ribble and Alt Estuaries are discussed with the relevant SNCBs to agree e.g., monitoring any impacts on the designated features, and consideration is given to adjusting the proposed cable route to avoid the designated conservation area entirely.	The Fylde MCZ and all other relevant designated sites have been identified in **section 2.6.2**, with the potentially affected designated habitats identified in **section 2.6.5**, and assessed for each impact in **section 2.11**. A full assessment of impacts to the Fylde MCZ is presented within the Transmission Assets MCZ Screening and Stage 1 Assessment Report (document reference: E4).
		Colonisation of artificial structures should be considered an effect, rather than an impact. To this regard, the introduction of artificial structures should be the direct impact from the project works which is scoped into the assessments, with colonisation of said structures by marine biota being noted as one of several subsequent effects.	The introduction of artificial structures, and subsequent colonisation, has been assessed for all relevant receptors in **section 2.11.6**.
	Natural England – Scoping Opinion	The ES should include a full assessment of the direct and indirect effects of the development on the features of special interest within internationally and nationally designated sites and should identify such mitigation measures as may be required in	All relevant internationally, nationally and locally designated sites including MCZs and SACs have been highlighted in **section 2.6.2** and features of sites included, as relevant, as IEFs. Potential impacts to features of designated sites have been assessed in **section 2.11**. Measures (commitments) adopted as part of the Transmission Assets to reduce potential impacts have been outlined in **section 2.8**, with the mitigation hierarchy also being followed to reduce and mitigate

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
		order to avoid, minimise or reduce any adverse significant effects.	effects where possible. Also, the project design parameters have been reduced through project refinement post-PEIR (**Table 2.12**).
		We would advise that the assessment takes into account the full extent of possible impact, e.g., taking the worst-case scenario for the extent of cable protection, and assessing impacts of all potential construction and cable installation methods that may be used. Preference however should be given to those methods that minimise habitat disturbance and destruction.	The MDS has been identified and assessed for each impact and is presented in **Table 2.12**. These scenarios have been selected from the project description provided in Volume 1, Chapter 3: Project description of the ES. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the project description (e.g., different infrastructure layout), to that assessed here be taken forward in the final design scheme.
		It would be appropriate to also include Natural England's Advice on Operations. For the designated sites within the scoping boundary, this will also provide sensitivity information for biotopes that could potentially occur within the scoping boundary, not just those that have been identified through existing data and surveys.	All relevant information relating to the sensitivity of receptors (including features of designated sites) has used to inform the assessments presented in **section 2.11**, including Natural England's Advice on Operations for designated sites.
		The suggestion of grouping habitats into IEFs will help with the presentation of complex information, however, care must be taken that sufficient consideration is given to specific protected habitats and species and that the most sensitive biotopes within each grouping are considered.	IEFs have been identified in **section 2.6.5**, with features of designated sites included as separate IEFs and assessed accordingly throughout the assessment. A precautionary approach has been adopted to determining the sensitivity of an IEF to a particular impact to ensure the most precautionary sensitivity is applied when combining pressures.
		Disagree that accidental pollution should be scoped out. Whilst following good practise and guidelines will reduce the likelihood of an accident occurring, it is not guaranteed that no accidents will occur, and therefore	As outlined in **Table 2.10**, the risk of an accidental pollution event occurring will be managed by the implementation of measures set out in standard post-consent plans (e.g., Offshore EMP (CoT65, **Table 2.11**), including an MPCP). Therefore, the likelihood of an accidental spill occurring is very low and in the unlikely event that such events occur, the magnitude of these will be minimised through

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		potential impacts should be considered accordingly and scoped into the assessment.	measures such as the MPCP such that no significant effect would occur. On this basis, this impact pathway has been scoped out, which the Applicants note is agreed by the Planning Inspectorate (see below in this table under 'Planning Inspectorate – Scoping Opinion').
	Planning Inspectorate – Scoping Opinion	The Scoping Report states that permanent habitat loss may occur under any infrastructure that is not decommissioned at the end of the Transmission Assets lifetime. In light of this the Inspectorate does not agree to scope this matter out.	Long term habitat loss has been scoped in with parameters provided in the MDS in **Table 2.12** and assessed in detail in **section 2.11.5**.
		The introduced artificial structures and the colonisation of said structures by marine biota is proposed to be left *in situ*. Therefore, the ES should assess the impact of the introduction of artificial structures and their colonisation as a likely effect during decommissioning where significant effects are likely to occur.	The introduction and colonisation of hard artificial structures has been scoped into the assessment for the construction and operation and maintenance phases of the Transmission Assets. The MDS is presented in **Table 2.12** with the full assessment in **section 2.11.6**. The permanent habitat loss/alteration resulting from infrastructure being left *in situ* post-decommissioning is assessed in **paragraph 2.11.5.22** *et seq*. and the risk of INNS during the decommissioning phase is assessed in **section 2.11.7**.
		The Inspectorate considers that during construction, there will be activities with potential to cause changes in physical processes e.g. laying cable protection and piling. As construction is anticipated to last three/four years, changes in physical processes may occur during this time. Therefore, the Inspectorate does not agree to scope this matter out. The ES should assess impacts to physical processes during construction and decommissioning where significant effects are likely to occur.	As per the assessment presented in Volume 2, Chapter 1: Physical processes of the ES, the potential changes in physical processes from the construction, operation and maintenance, and decommissioning of the Transmission Assets have been scoped into the MDS in **section 2.9.1** and assessed in **section 2.11.9**.

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
		The Scoping Report states that the benthic and intertidal surveys undertaken to date have covered ‘a refined area’ of the scoping boundary. The survey locations should be presented on a figure within the ES.	Survey locations have been presented in detail in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES and in Figure 2.3 in Volume 2, Figures.
		Consideration of designated sites should also include SPAs, which have benthic habitats that are designated as supporting habitats for the bird features.	SPAs have been identified in **section 2.6.2**, with the Liverpool Bay/Bae Lerpwl SPA and Ribble and Alt Estuaries SPA identified as overlapping the Transmission Assets survey area. Effects on the ornithological features of the Liverpool Bay/Bae Lerpwl SPA and Ribble and Alt Estuaries SPA, including an assessment of the effects of temporary habitat and increased SSCs on ornithological receptors, are however assessed in Volume 2, Chapter 5: Offshore ornithology of the ES and in the HRA Stage 2 ISAA (document reference: E2.1, E2.3 and E2.3).
		Accidental pollution during construction, operation and maintenance and decommissioning. The inspectorate agrees this can be scoped out.	The potential for accidental pollution during all phases of the Transmission Assets has been scoped out and not assessed further, with the potential for this impact to be controlled by the MPCP within the Offshore EMP (CoT65) outlined in **Table 2.11**.
		The ES should establish what impacts are temporary, medium and long term in relation to the receptor being impacted where it has influence on the assessment of significance.	The methods for defining the duration of impacts are outlined in **section 2.10**, and the specific assessments in **section 2.11** take these durations into account when determining significance.
		The EIA Scoping Report states that the benthic and intertidal surveys undertaken to date have covered ‘a refined area’ of the scoping boundary. The survey locations should be presented on a figure within the Environmental Statement.	The locations of the benthic subtidal samples are presented in Figure 1.4 of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES and the extent of the intertidal Phase I walkover survey is shown in Figure 1.27 of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		The scoping report states the survey was conducted within a ‘refined area of the transmissions assets scoping boundary’ and then goes onto say the sampling strategy	The baseline characterisation of the study area based on desktop data has been presented in section 1.3.2 of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES. The results of site-specific surveys at the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore

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		was 'designed to adequately sample the area… for benthic characterisation'. The results of this site-specific survey, and that of the comprehensive desk-based review, will be presented subsequently as a technical report in the Environmental Statement.	Windfarm: Generation Assets have also been included as a desktop data source in **section 1.3.3** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES. The results of the Transmission Assets site-specific benthic survey is presented in **section 1.4.2** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES, and for the intertidal survey in section 1.4.3 of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
March 2023	Natural England, MMO, Environment Agency and Cefas – 1st benthic ecology, fish and shellfish and physical processes EWG	Summary of the preliminary results of the site-specific benthic subtidal and intertidal surveys. An up to date West of Walney MCZ monitoring report was highlighted, with associated OneBenthic portal data, with this requested to be added where relevant.	All relevant data, including the West of Walney MCZ monitoring report, has been incorporated into the baseline in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES, with this summarised in **section 2.6**.
July 2023	Natural England, MMO, Environment Agency, Cefas and Cumbria Wildlife Trust – 2nd benthic ecology, fish and shellfish and physical processes EWG	Summary of the site-specific surveys and baseline characterisation to be presented in the Preliminary Environmental Information Report including IEFs identified. Natural England noted there is a license area, number 457, for which Westminster gravels have submitted a Scoping EIA Report and are planning on submitting the ES during Q2/Q3 of 2024. Cefas were pleased to note the inclusion of the seapens and burrowing megafauna community in the assessment. Natural England queried, when determining the significance of effect and picking between the two possible categories, if it is possible to choose the more conservative	Licence area 457 has been included as a project in the CEA (see **Table 2.25**). The seapens and burrowing megafauna community has been included with the "subtidal muddy sands with relatively species poor benthic communities" IEF. The methodology is presented in **section 2.10.4** and is consistent with the EIA methodology outlined in Volume 1, Chapter 5: Environmental assessment methodology of the ES, so applies to all topics. Where a range of significance levels are presented, the final assessment for each effect is based upon expert judgement. In all cases, the evaluation of receptor sensitivity, impact magnitude and significance of effect has been informed by professional judgement and is underpinned by narrative to explain the conclusions reached. The full MDS for long term habitat loss is presented in **Table 2.12** and the assessment in **section 2.11.5**.

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
		approach and therefore choosing the more impactful result. Natural England requested clarity on the conclusions of the long term habitat loss assessment.	
November 2023	Isle of Man Department of Infrastructure – Section 42 Comments	The TSC would draw the Applicant's attention to the Manx Marine Environmental Assessment 2 (MMEA) which provides a useful overview of the Island's marine environment and should be taken into account as part of both the transboundary and possibly also the cumulative impacts assessment as part of this application.	The Manx Marine Environmental Assessment 2 has been reviewed and used to determine the regional baseline environment (**section 2.5** and **Table 2.5**, with full details provided in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES).
	MMO – Section 42 Comments	MMO agrees with the justifications and mitigations presented and the decision to scope out the effects of accidental pollution. The MMO advise that the risk of chemical breakout during HDD, or similar, is assessed.	The impact of disturbance/remobilisation of sediment-bound contaminants, has been assessed in **section 2.11.4**. The potential use of trenchless techniques, with the associated risk of bentonite breakout, is addressed in **section 2.11.2**.
		Schedule 14 of the Draft Deemed Marine Licence (dML) includes reference to the requirement for pre- and post-construction monitoring surveys "to determine the location, extent and composition of any benthic habitats of conservation, and/or ecological importance constituting Annex 1 reef habitats in the parts of the Order limits in which it is proposed to carry out construction works". MMO welcomes this.	Benthic monitoring has been considered in the Outline Offshore in-principle monitoring plan (OIPMP) (document reference: J20) and is detailed in **section 2.11.12**.

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		MMO had concerns regarding the quality of the sediment chemistry data and the concentrations observed.	The sediment chemistry data has been reviewed post-PEIR and any inconsistencies corrected in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		Given that there will be approximately more than 1 cubic megametres (Mm^3) of material to be cleared in terms of sandwaves, a designation of a disposal site for the Transmission Asset works will be necessary, and adequate characterisation for the site should be provided ensuring the chemical analysis is appropriate.	A Dredge and Disposal Site Characterisation Plan (document reference: J22) has been prepared and is submitted with the ES.
		MMO notes that a comprehensive search of relevant data sources has been undertaken during a desk study and site-specific benthic surveys have been carried out in support of the application. The results of which have facilitated the identification and assessment of the potential impacts to benthic ecology receptors.	The desktop data sources used to inform the baseline characterisation are outlined in section 1.3 of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		The analysis of the Polychlorinated Biphenyl (PCB) contaminants were only tested for the International Council for the Exploration of the Sea (ICES)-7 congener group and should be re-examined for comparison to the 25PCB contaminants group, as this will provide a more appropriate assessment of the potential impact of these contaminants.	The full results from the PCB analysis (including the 25PCB contaminants group) are presented in Appendix C.2 of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES, and a summary of the results are presented in section 1.4.2 of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		The trace metals and Polycyclic Aromatic Hydrocarbons (PAHs) results for each sample are presented in Appendix C of the report. The report states that the PCB	The full results from the PCB analysis are presented in **Appendix C.2** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES, and a summary of the results are presented in **section 1.4.2** of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.

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		results are present in Appendix C too, however these appear to be absent. Given the concerns with the interpretation of the PCB data, the MMO requests that these data are added to the Appendix for full review.	
		With respect to site-specific surveys in the Transmission Assets area, it would have been preferable to first conduct Particle Size Analysis (PSA), and then use those results to determine which samples should be tested for contaminants (e.g., any sites with >30% fine material, or test all samples for contaminants).	The benthic subtidal survey specification was agreed with the SNCBs prior to mobilising the surveys, but sample locations were adjusted in the field to ensure adequate spread of samples across all sediment types.
		Clarify the accreditation status of the labs used for PSA.	The PSA was carried out by Kenneth Pye Associates Ltd. and Ocean Ecology (both MMO validated laboratories), as detailed in section 1.4.1 of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		The report concludes that the levels of most trace metals and PAHs are low throughout the dataset. The MMO agrees with this conclusion given the results presented, and the data for these contaminants are high confidence as SOCOTEC were the contracting laboratory (who are validated for both analyses by the MMO).	Noted and most trace metals, PAHs and PCBs were below the relevant impact thresholds, and the results are summarised in section 1.4.2 of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES and presented in full in Appendix C.2 of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
	Natural England – Section 42 Comments	The range of desktop study reports used is useful, although more review work should be done to find and use the most up-to-date reports available, as many are over 10 years old and may have lower levels of applicability to current conditions.	A range of data sources have used to inform the assessment in this chapter and are listed in full in section 1.2.5 of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
		Ensure all mentioned surveys are appropriately referenced and utilised throughout the report, including Gardline, XOcean, and Fugro survey reports.	All relevant surveys are referenced in Table 1.4 of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES with a summary of the findings of the geophysical surveys provided in section 1.4.2 of Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
		Natural England provided detailed responses relating to the impacts on the Fylde MCZ including concerns relating to the extent of cable protection and associated long term habitat loss, the extent of sandwave clearance and a request for a commitment to remove cable protection as part of the Decommissioning Plan. These responses have been fully detailed in the MCZ Screening and Stage 1 Assessment but, to avoid duplication, have not been repeated in this chapter.	In acknowledgment of the mitigation hierarchy and to incorporate feedback from Natural England, a number of project design refinements have been made between the PEIR and ES. These refinements have significantly reduced the requirements for cable protection (and associated long term habitat loss) within the Fylde MCZ. The cable protection parameters in the Fylde MCZ have reduced from 20% to 3% contingency for the Morgan export cables (excluding cable crossings) and from 15% to 3% contingency for the Morecambe export cables. It should be noted that the aim is to bury all cables in the first instance and only where this is unsuccessful or where a cable crossing is required would cable protection be used. Cable protection within the Fylde MCZ will only be used where deemed to be essential (CoT47, **Table 2.11**). As outlined in **Table 2.11**, the has Applicants have committed to ensuring that all external cable protection used within the Fylde MCZ will be designed to be removable on decommissioning (CoT108, **Table 2.11**) with the requirement for removal agreed with stakeholders and regulators at the time of decommissioning (CoT109, **Table 2.11**). An Outline CBRA (document reference J14) and, Outline Offshore CSIP (CoT45, document reference: J15) is included with the application (see **Table 2.11**). A number of project design refinements have also been made between the PEIR and ES for sandwave clearance. Sandwave clearance in the Fylde MCZ has reduced from 60% to 5% for the Morgan export cables and from 30% to 5% for the Morecambe export cables (CoT47, **Table 2.11**). It should also be noted that sandwave clearance is an important tool to facilitate the successful burial of cables and to minimise the requirements for external cable protection. Whilst these comments have been addressed in the MCZ Screening and Stage 1 Assessment Report (document reference: E4), updates have also been made to the relevant sections of this chapter and the assessment, in EIA terms, of the impacts to the features of the Fylde MCZ which have been identified as IEFs.

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
		While Natural England supported the use of sandwave levelling as a form of mitigation measure to reduce the using cable protection; there was a considerable amount of sandwave clearance and seabed preparation footprint proposed. Natural England advised that all efforts should be made to avoid areas of sandwaves or minimise the need for clearance by micro-routing cables. Therefore, Natural England encourage refinement of the MDS as much as possible.	The MDS for sandwave clearance has been refined post-PEIR. These refinements have significantly reduced the requirements for sandwave clearance (and associated temporary habitat disturbance) from 60% to 10% for the Morgan export cables and from 30% to 10% for the Morecambe export cables. The width of the sandwave clearance corridor has also reduced from 104 m to 60 m for the Morgan cables and 48 m for the Morecambe cables. This has contributed to a decrease in the amount of temporary habitat disturbance/loss associated with export cable installation (and associated site preparation) from 35,112,000 m^2 at PEIR to 11,331,680 m^2 for the ES. Additionally there has been a decrease in the area affected by sandwave clearance material deposition associated with export cables from 16,326,400 m^2 at PEIR to 2,853,600 m^2 at ES.
		Natural England requested clarity around the sandwave volume MDS figures, namely: • Length of cable route requiring sandwave clearance (km) • Width of sandwave clearance disturbance corridor (m) • Indicative depth of sandwave clearance dredging (m) • Area of seabed disturbed by sandwave clearance (m^2) • Seabed preparation areas for foundations (m^2).	The length, width and area of sandwave clearance has been provided in **Table 2.12,** noting that since PEIR, the offshore substation platforms (OSPs), the Morgan offshore booster station and interconnector cables have been removed from the project description for the ES. The depth of sandwave clearance is not relevant to calculations regarding the temporary habitat disturbance area.
		Natural England noted where the cable corridor crosses an area of high-density boulders and coarse material, the developer should consider micro-siting if there is capacity within the planned cable corridor.	Micrositing of cables around boulders would be onerous and impractical. Boulders pose a risk of damage and exposure to cables as well as an obstruction risk to the cable installation equipment. As detailed in full in Volume 1, Chapter 3: Project description of the ES, any boulders identified as likely to impact installation will therefore need to be moved to the side (side cast), away from the immediate location of the cable infrastructure. There are two key methods of clearing boulders, boulder plough and boulder grab. Where a high density of

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
			boulders is seen, the expectation is that a plough will be required to clear the cable installation corridor. Where medium and low densities of boulders are present, a subsea grab is expected to be employed. Boulder clearance will occur within the footprint of other site preparation activities. All boulders will remain in the vicinity (i.e. sidecast only) of the area they were cleared from.
		Natural England advised that the MDS for boulder clearance has not been defined, it has been assumed this falls within the seabed preparation footprint. However, MDS for boulder clearance should also include consideration for the fate of removed boulders. The total area of impact presented in the submitted ES should consider where the boulders are placed, as well as where they are removed from.	The length of cables potentially requiring boulder clearance as well as the width of the disturbance corridor have been included in **Table 2.12**. Volume 1, Chapter 3: Project description of the ES, states that boulders will be side cast away from the immediate location of the cable infrastructure. Boulder clearance is assessed in **section 2.11.2** as temporary habitat disturbance (rather than loss) as the process will effectively redistribute boulders and cobbles within discrete areas. Given the patchiness of the distribution of boulders in the survey area, this is considered unlikely to represent a significant shift in the baseline and, since no sediment/substrate is being removed, this will not act as a barrier for the recovery of any epifaunal communities impacted during the process. Furthermore, the MDS assumes that all of the habitat within the boulder clearance corridor will be disturbed (i.e. the situation in the event that a plough us used) but, in reality, it is likely that some parts will only require clearance via a subsea grab. This methodology would be more targeted and would result in less habitat disturbance than that assumed for the MDS.
		The application should provide sufficient information to assess the size and depths of craters associated with UXO clearance within the ES and commit to avoiding sensitive benthic receptors. A more detailed assessment of potential crater impacts should be included within the final application.	The MDS of UXO clearance is outlined in **Table 2.12**, and an assessment of the impacts presented in **section 2.11.2**.
		Natural England noted that the MDS for OSPs is high when compared to other projects of a similar scale. Natural England advised that this is refined.	As detailed in full in Volume 1, Chapter 3: Project description of the ES, as part of the project design refinements between PEIR and final Application, OSPs and the Morgan offshore booster station have been removed from the Transmission

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
			Assets project design. The assessments presented in this chapter have been updated to reflect this amendment.
		Natural England noted that it is not clear whether secondary scour has been included in the project description and MDS parameters.	The impacts of secondary scour on benthic receptors has been considered within the Transmission Assets alone assessment and CEA of the ES, as per **section 2.11.9** and **section 2.13.8**.
		Natural England queried whether the 10 m width of export cable protection was per cable or in total (i.e. six cables).	The MDS outlined in **Table 2.12,** details the width of export cable protection for up to four Morgan export cables is 10 m (per cable) and for up to two Morecambe export cables it is 13 m (per cable).
		For the Transmission Assets the magnitude and areas affected by cable protection will be specific to the location, i.e. water depth, orientation to tidal flow and length of continuous protection. From the modelling undertaken for the Mona and Morecambe Offshore Wind Project PEIR it may be concluded that Fylde MCZ and designated areas associated with the Ribble Estuary may be affected if cable protection is placed within these areas. Additionally, the effects of cable protection within the nearshore will be mitigated with the use of low profile tapered mattressing to be detailed in the CSIP. The area which should be exempt to cable protection to prevent impacts on sediment transport should be further defined and extended to the depth of closure based on average significant wave heights and secured appropriately in the application.	Cable protection within the Fylde MCZ may be required for up to 3% of the total cable route within the MCZ (CoT47). There will be a single cable crossing required for the Morgan offshore export cables (a single crossing for all four cables) at the west edge of the Fylde MCZ. All external cable protection used within the Fylde MCZ will however be designed to be removable on decommissioning (CoT108) with the requirement for removal agreed with stakeholders and regulators at the time of decommissioning, as described in **Table 2.11** (CoT109). This comment therefore falls in line with the commitments and approach proposed within the ES. Further information regarding the commitments list can be found in Volume 1, Annex 5.3: Commitments register of the ES. The impact of cable protection within the MCZ is assessed within the assessment of effects in **section 2.11.5**. Further details regarding the project description are presented in Volume 1, Chapter 3: Project description of the ES. The Outline Offshore CSIP for the Fylde MCZ (document reference J15) also includes detail regarding depth of cable burial, cable protection, and cable monitoring. The Outline Offshore CSIP also includes an Outline CBRA. Detailed CSIP(s) and CBRA(s) will be prepared by the Applicants covering the full extent of their respective offshore export cable corridors. Detailed CSIPs will be developed in accordance with the Outline CSIP and will ensure safe navigation is not compromised including consideration of under keel clearance. No more than

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
		The depth of cable burial should be defined in the CSIP and agreed in order to prevent the need for cable protection. There should be a commitment made in the DCO to remove cable protection from the 'nearshore' as part of the decommissioning plan. Any cable protection used should be designed to be removeable to prevent permanent impacts.	5% reduction in water depth (referenced to Chart Datum) will occur at any point on the offshore export cable corridor route without prior written approval from the MCA.
		There should be a commitment made in the DCO to remove cable protection from the 'nearshore' as part of the decommissioning plan. Any cable protection used should be designed to be removeable to prevent permanent impacts.	In the decommissioning phase of the Transmission Assets most infrastructure (cables, cable protection and cable crossings) will remain *in situ* however the Applicants have committed to ensuring that all external cable protection used within the Fylde MCZ will be designed to be removable on decommissioning (CoT108, **Table 2.11**) with the requirement for removal agreed with stakeholders and regulators at the time of decommissioning (CoT109, **Table 2.11**).
		Natural England noted the parameters for cable crossings had not been defined in this Chapter. Natural England requested the developer to please provide further information on MDS parameters for cable crossing (i.e. indicative number of crossings, specific locations, overlap with MPAs etc) and methodology in line with best practise guidance. The potential interruption of sediment transport and resulting morphological change due to the presence of cable crossings near sensitive receptors and pathways should also be considered in the ES.	Information regarding cable crossings has been provided in **Table 2.12** including the quantity, length and width. The number of cable crossings within the overlap with the Fylde MCZ is also specified in **section 2.11.5** and is discussed in greater detail in **section 2.11.5**. The locations of the cable crossings are provided in Offshore Crossing Schedule (document reference F1.3.1). The potential impact of cable crossings on sediment transport and seabed morphology is assessed in relation to the changes in physical processes impact (**section 2.11.9**).
		Natural England noted that Westminster Gravels will be renewing their aggregate extraction licence in Area 457 in Liverpool	The Liverpool Bay aggregate extraction site (area 457) has been included in the CEA (**section 2.13**).

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
		Bay (please see: EIA/2023/00003). Currently this proposal is In early EIA scoping stages, the ES is expected to be submitted in Q2 2024. Consideration may need to be given to this proposal in the submitted CEA.	
		Natural England noted that the Mersey Tidal Power Project has been scoped out in the screening matrix of the PEIR. However, this may need to be given further consideration as the project progresses. Consideration may need to be given to this proposal in the submitted CEA.	This project has been reviewed and has been screened out of the CEA for benthic subtidal and intertidal ecology on the basis of low data confidence (full details provided in Volume 1, Annex 5.5: Cumulative screening matrix and location map of the ES).
		Natural England highlighted that in some instances where sensitivity of a habitat is measured as medium to one pressure that is likely to be exerted, Natural England would argue that sensitivity to a second pressure being low does not average out to low sensitivity over the two pressures. Natural England recommends that the most precautionary sensitivity is used when combining pressures.	The Transmission Assets alone assessment (**section 2.11**) has been checked and corrected where necessary to ensure that the most precautionary sensitivity is applied when combining pressures.
		Natural England noted numerous instances where significance has been presented as a range (i.e., slight, or moderate, or large) and it is nearly always the lower value that has been taken forward. Natural England's view was that the higher value should always be assessed in order to ensure that impacts on features are not incorrectly screened out of further assessment.	As per the assessment methodology (**section 2.10**) where the sensitivity and magnitude combine to produce a range of potential significance in the assessment matrix (**Table 2.16**) expert judgement is used to determine the final significance taken forward in the assessment. Where these decisions are made in the Transmission Assets alone assessment (**section 2.11**) and explanation has been provided as to why the final significance was chosen.

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
		Natural England was concerned that no future monitoring is being proposed to test predictions being made within the impact assessment. An appropriate Benthic Monitoring Plan should be established at key impact locations that spatially and temporally represent all impacted biotopes, habitats, and species. Adequate data should be collected for long term comparisons of the effect of change compared to baseline data.	Benthic monitoring has been considered in the Outline OIPMP (document reference: J20) and is detailed in **section 2.11.12**.
		Natural England advised that more detail on the anticipated locations of turbines and their type of foundation is required in order to more accurately assess the impacts on benthic ecology.	Wind turbines are not included as part of the project description for the Transmission Assets therefore further detail has not been included. This will be assessed as part of the respective DCO applications for the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets.
		The MDS assumes the complete removal of all foundations and cables but that all cable and scour protection may be left *in situ*. Natural England advised that if cable and scour protection is left *in situ*, this would equate to permanent changes in the benthic complexity of the site. Having permanent hard infrastructure present may impact the natural sedimentary process in the area. Additionally, it will increase the risk of phase shifts in benthic community composition (including invasive non-native species) due to the addition of hard substate.	Since PEIR, substation platforms (OSPs) and the Morgan offshore booster station have been removed from the MDS (see Volume 1, Chapter 3: Project description for the ES). The MDS has been updated post-PEIR to assume that all cable protection outside the overlap of the cable corridor with Fylde MCZ will be left *in situ*. The Applicants have committed to ensuring that all external cable protection used within the Fylde MCZ will be designed to be removable on decommissioning (CoT108, **Table 2.11**) with the requirement for removal agreed with stakeholders and regulators at the time of decommissioning (CoT109, **Table 2.11**). Cable protection remaining *in situ* has therefore been assessed as permanent habitat alteration in **section 2.11.5** as suggested by Natural England. Additionally an increased risk of introduction of INNS in the decommissioning phase has been assessed in **section 2.11.7**. Scour protection is no longer part of the project description for the Transmission Assets therefore it has not been considered in the Transmission Assets alone assessment (**section 2.11**).

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
		Natural England advise that the definition of temporary needs to be clearly defined as this might vary depending on the scale of reference used.	A definition of 'temporary' has been provided in **section 2.10.3** alongside the definitions of short, medium, and long term.
		An evaluation on how key species and biotopes will respond to predicted worst case disturbance should be modelled using baseline date, underlying knowledge of life history traits and ecological processes. This predicted rate of recovery should then be modelled and tested regarding the expected worse case time scenario of the various project stages.	The methodology for undertaking the EIA was consulted on In the Scoping Report which outlined that the benthic assessment would draw upon the evidence in the Marine Evidence based Sensitivity Assessment (MarESA). The MarESA is peer reviewed and represents the largest review undertaken to date on the effects of human activities and natural events on marine species and habitats. It is considered to be one of the best available sources of evidence relating to recovery of benthic species and habitats. The evidence presented in this chapter on recoverability is therefore deemed to be sufficient and robust to inform the assessment.
		Natural England noted from experience on other windfarms, HDD can fail on occasion. Therefore, the applicant should ensure that the worst case scenario at landfall takes this into consideration. This should consider impacts on Lytham St. Annes Dunes SSSI with a sufficient baseline collected to assess impact post construction.	The offshore export cables between the transition joint bay working area and the beach will be installed using trenchless techniques. The trenchless techniques will exit on the beach with a minimum offset distance of 15 m from boundary of the Lytham St Annes Dunes SSSI as outlined in **Table 2.11**, the Applicant has committed to ensuring that all trenchless crossings will be undertaken by non-impact methods such as HDD (or other trenchless techniques including micro tunnelling and direct pipe), excluding preparatory works, in order to minimise construction noise and vibration beyond the immediate location of works. Impacts to the features of the Lytham St. Annes Dunes SSSI are assessed in Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES. The MDS for intertidal benthic receptors includes a 300 m long open cut trench for each of the six offshore export cables from the point that the trenchless techniques exit on the beach. The MDS also includes for marinised trenching for the remaining length of the intertidal (see **Table 2.12**). Marinised trenching dis a method of trenching which will be undertaken in the wet (i.e. rather than in the dry when the tide is out) which includes machine-instigated initiation of backfill of the trench to support natural backfill.

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	Northwest Wildlife Trust – Statutory Consultation	Whilst Northwest Wildlife Trust recognises that Biodiversity Net Gain policies and delivery frameworks are more developed for terrestrial and intertidal habitats than they are for the marine environment, we would still expect Morgan and Morecambe Offshore Windfarms to aim to achieve an overall net positive impact on biodiversity and ecology in the marine environment.	The Marine enhancement Statement (document reference: J12) outlines the approach of the Transmission Assets to biodiversity enhancement.
		Northwest Wildlife Trust highlight that there is an indication that the design, construction, and management of cable corridors can serve to mitigate the need for benthic compensation, and potentially even serve as compensation themselves by enhancing and improving the condition of these habitats. Further, excluding activities that could damage surface laid cables would preclude the need for cable protection.	The Marine enhancement Statement (document reference: J12) outlines the approach of the Transmission Assets to biodiversity enhancement. Additionally the MCZ Screening and Stage 1 Assessment Report (document reference: E4) provides detail on how the mitigation hierarchy has been employed to minimise the impact upon habitats within the Fylde MCZ including reducing cable protection.
		Northwest Wildlife Trust expect the EIA for the scheme to assess the potential impacts on marine ecology outside MPAs and propose suitable mitigation and compensation to achieve an overall benefit to these habitats and wider marine ecology from the scheme.	This chapter provides an assessment for all benthic subtidal and intertidal habitats which may be impacted by the Transmission Assets both within and outside designated sites. **Table 2.11** details commitments which have been made to minimise the impact of the Transmission Assets on benthic habitats.
		Given the proximity to Welsh waters and Isle of Man, the Northwest Wildlife Trust expect there to be full consideration of transboundary effects and cumulative impacts across borders.	Wales is part of the UK, and the Isle of Man is a Crown Dependency of the UK and not a European Economic Area (EEA) State. Therefore, Regulation 32 of the EIA Regulations does not apply to the Isle of Man. As such, potential impacts upon environmental receptors within the Isle of Man are not considered to be transboundary. As outlined in **paragraphs 2.5.1.4** and **2.5.1.5**, the MNRs around the Isle of Man, are outside the ZOI and so will not be affected by the

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
			Transmission Assets. These sites have, therefore, not been considered further in this chapter.
		Northwest Wildlife Trust noted that every effort should be taken to limit and reduce cable protection in soft sediments, particularly designated areas and MCZs. New hard substrate will represent a shift in the baseline conditions from soft substrate areas (i.e. muds, sands and gravels) to hard substrate in the areas where infrastructure is present and therefore full consideration needs to be considered for the change in ecological conditions and the impact of this.	Post-PEIR the MDS has been refined and the amount of cable protection has been reduced overall including the section of the Transmission Assets that overlaps with the Fylde MCZ (CoT47, **Table 2.11**). The impact of the cable protection is assessed in **section 2.11.5**, with the area of cable protection within the Fylde MCZ reducing from 159,580 m^2 in the PEIR to 30,400 m^2 post-PEIR, a reduction of 80.95%.
	NRW Advisory (A) – Statutory Consultation	In terms of the screening for cumulative projects, NRW (A) advised the offshore elements of Hynet North West Carbon Capture and Storage (CCS) project should be screened in.	The Hynet CCS project has been included in the CEA (**section 2.13**).
		NRW (A) noted that on the listed projects included for assessment of cumulative effects, the Isle of Man offshore wind farm Mooir Vannin is due to be constructed by 2030 so should also be included.	The Mooir Vannin Offshore Wind Farm and the Mooir Vannin - UK Transmission Assets have been included in the CEA (**section 2.13**).
February 2024	MMO, Environment Agency and Cefas – 3rd benthic ecology, fish and shellfish and physical processes EWG: Meeting one	This meeting provided consultees with an update on post-PEIR design changes and also highlighted the key points raised in the Section 42 comments following the submission of the PEIR. These comments are addressed in the above responses. No comments were raised by the attendees at this meeting which were relevant to this	See responses to the Section 42 comments above.

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
		chapter or Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.	
	Natural England – 3rd benthic ecology, fish and shellfish and physical processes EWG: Meeting two	This meeting provided consultees with an update on post-PEIR design changes and also highlighted the key points raised in the Section 42 comments following the submission of the PEIR. These comments are addressed in the above responses. Natural England raised a number of points relating to the MCZ Screening and Stage 1 Assessment. Natural England confirmed that they expect an Outline CBRA to be submitted with the application.	See responses to the Section 42 comments above but the comments relating specifically to discussions on the Fylde MCZ are considered fully in the MCZ Screening and Stage 1 Assessment Report (document reference: E4). As outlined in **Table 2.11**, an Outline Offshore CSIP (CoT45, **Table 2.11**) (document reference: J15) and an Outline CBRA (document reference J14) is included with the application.
August 2024	MMO, Natural England, Environment Agency and Cefas – 4th benthic ecology, fish and shellfish and physical processes EWG	This meeting provided consultees with an update on post-PEIR design changes of relevance to the Fylde MCZ only. The meeting also provided details on the content of the Outline Offshore CSIP and Outline CBRA. Natural England made comments relating to the proposed commitments including in relation to monitoring, jack-ups in the Fylde MCZ and the deposition of sandwave clearance material.	As outlined in **Table 2.11**, since this EWG the Applicant has added a commitment (CoT117) to ensure that any jack-up vessels used within the Fylde MCZ will be stationary and no walking jack-ups will be used within the Fylde MCZ. Additionally, the wording in CoT115 (**Table 2.24**) relating to monitoring within the Fylde MCZ has been amended in line with Natural England's comments regarding not including specific timeframes for monitoring.

2.4 Study area

2.4.1.1 The Transmission Assets benthic subtidal and intertidal ecology study area (hereafter referred to as the study area) encompasses the wider east Irish Sea, extending from MHWS out to the furthest west extent from the Mull of Galloway in Scotland and to the west tip of Anglesey. This study area has been selected to encompass the wider Irish Sea habitats and includes the neighbouring consented and proposed offshore wind farms and designated sites (Figure 2.1, see Volume 2, Figures).

2.4.1.2 The study area has been characterised by desktop data (including the site-specific benthic data collected within the Offshore Order Limits for the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets) and provides a wider context to the site-specific data for the Transmission Assets collected within the Transmission Assets benthic survey area (i.e. excluding the Generation Assets). The study area is large enough to incorporate all direct and indirect impacts of the Transmission Assets on benthic subtidal and intertidal receptors. The study area is the same as the regional benthic subtidal and intertidal ecology study area defined for the Morgan Offshore Wind Project: Generation Assets (Volume 2, Chapter 2: Benthic subtidal and intertidal ecology of the ES; Morgan Offshore Wind Ltd, 2024a) and also fully encompasses the study area defined for the Morecambe Offshore Windfarm: Generation Assets (Volume 1, Chapter 9: Benthic ecology of the ES; Morecambe Offshore Windfarm Ltd, 2024a).

2.4.1.3 Site-specific data from within the Transmission Assets benthic survey area, (hereafter referred as the survey area; see Figure 2.1, (Volume 2, Figures)), has also been used to further characterise the study area. The survey area is defined as the area within the Offshore Order Limits, excluding the Generation Assets, and is the area within which site-specific subtidal and intertidal surveys were undertaken in 2022.

2.4.1.4 The CEA benthic subtidal and intertidal ecology study area has been defined as a 50 km buffer around the Transmission Assets. This 50 km buffer is designed to capture all the relevant projects/plans/activities which have the potential to interact with the impact of the Transmission Assets. For interactive/synergistic impacts (i.e. increase in suspended sediment concentration and changes in physical processes) the study area was defined by the CEA physical processes study area (as outlined in Volume 2, Chapter 1: Physical Processes of the ES) which is defined as two tidal excursions surrounding the Transmission Assets.

2.5 Baseline methodology

2.5.1 Methodology for baseline studies

Desk studies

2.5.1.1 A comprehensive desk-based review has been undertaken to inform the baseline for benthic subtidal and intertidal ecology. The existing studies and datasets referred to as part of the desk-based review are summarised in **Table 2.5**. These desk studies provide further context to the site-specific surveys.

2.5.1.2 The desk study has specifically considered sediment characteristics and contamination, subtidal and intertidal benthic ecology, and the location and characterisation of nearby designated sites.

2.5.1.3 The site-specific baseline characterisation surveys undertaken for the Generation Assets (Morgan Offshore Wind Ltd, 2024a and Morecambe Offshore Windfarm Ltd, 2024b), have also been incorporated in the desktop data review.

Table 2.5: Summary of desk study sources

Title	Source	Year	Author
Mona Offshore Wind Project Volume 2 Chapter 2: Benthic subtidal and intertidal ecology of the ES	Mona Offshore Wind Ltd	2024	Mona Offshore Wind Ltd
Morecambe Offshore Windfarm: Generation Assets Volume 2, Chapter 2: Benthic subtidal ecology of the ES.	Morecambe Offshore Windfarm Ltd	2024a	Morecambe Offshore Windfarm Ltd
Morecambe Offshore Windfarm: Generation Assets Volume 1, Appendix 9.1: Benthic Characterisation Survey Report of the ES.	Morecambe Offshore Windfarm Ltd	2024b	Morecambe Offshore Windfarm Ltd
Morgan Offshore Wind Project: Generation Assets Volume 2 Chapter 2: Benthic subtidal ecology of the ES.	Morgan Offshore Wind Ltd	2024a	Morgan Offshore Wind Ltd
Morgan Offshore Wind Project: Generation Assets Volume 4 Annex 2.1: Benthic subtidal ecology of the ES.	Morgan Offshore Wind Ltd	2024b	Morgan Offshore Wind Ltd
Licence Area 457 Environmental Impact Assessment – Scoping Report	MarineSpace	2023	MarineSpace Ltd
Awel y Môr Environmental Impact Assessment, Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology	RWE	2022	RWE
UK Offshore Energy Strategic Environmental Assessment (OESEA). Future Leasing/Licensing for Offshore Renewable Energy, Offshore Oil and Gas and Gas Storage and Associated Infrastructure. OESEA4 Environmental Report. Appendix 1: Environmental baseline	Department for Business, Energy and Industrial Strategy (BEIS)	2022	BEIS

Title	Source	Year	Author
The National Biodiversity Network (NBN) Gateway	NBN Atlas	2022	NBN Atlas
Lle Geo-Portal for Wales	Welsh Government	2021	Welsh Government
European Marine Observation and Data Network (EMODnet) broadscale seabed habitat map for Europe (also known as the EUSeaMap)	EMODnet-Seabed Habitats	2021	EMODnet-Seabed Habitats
Subtidal Ecology. In: Manx Marine Environmental Assessment (2nd Ed).	The Government of the Isle of Man	2018a	Howe
Coastal Ecology. In: Manx Marine Environmental Assessment (2nd Ed).	The Government of the Isle of Man	2018b	Howe
Burbo Bank Offshore Wind Farm Benthic and Annex I Habitat Pre-construction Survey Field Report	Burbo Bank Offshore Wind Farms (United Kingdom (UK)) Ltd/DONG Energy	2015	Centre for Marine and Coastal Studies (CMACS)
Rhiannon Offshore Wind Farm Preliminary Environmental Information Chapter 9 Benthic Ecology	Celtic Array Ltd.	2014	Celtic Array Ltd
Burbo Bank Extension Offshore Wind Farm ES Volume 2 – chapter 12: Subtidal and Intertidal Benthic Ecology	Dong Energy Ltd.	2013	Dong Energy Ltd
Walney Extension ES Volume 1, chapter 10: Benthic Ecology	Dong Energy Ltd.	2013	Dong Energy Ltd
Walney Offshore Wind Farm Year 1 post-construction benthic monitoring technical survey report (2012 survey)	Walney Offshore Wind Farms (UK) Ltd/DONG Energy	2013	CMACS
Ormonde Offshore Wind Farm Year 1 post-construction benthic monitoring technical survey report (2012 survey)	RPS Energy	2012	CMACS
A Review of the Contaminant Status of the Irish Sea	JNCC	2005	Cefas
Gwynt y Môr Offshore Wind Farm Marine Benthic Characterisation Survey	Gwynt y Môr Offshore Wind Farm Ltd	2005b	CMACS
Marine Phase 1 Intertidal Habitat Survey	NRW	2005	NRW
Phase I- Intertidal Survey- Standard Report'	Countryside Council for Wales (CCW)	2004	CCW

Title	Source	Year	Author
North Hoyle Offshore Wind Farm Environmental Statement	Innogy NWP offshore Ltd.	2002	Innogy
Broadscale seabed survey to the east of the Isle of Man	Holt *et al*.	1997	Holt *et al*.

Identification of designated sites

2.5.1.4 All designated sites including SACs, MCZs, MNRs, SSSIs, Ramsar sites and SPAs within the study area were identified in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES. The designated sites and their relevant qualifying benthic features that could be affected by the construction, operation and maintenance, and decommissioning of the Transmission Assets (i.e. that fall within the potential ZOI of the Transmission Assets), were identified using the process below.

- Step 1: All designated sites of international, national and local importance within the benthic subtidal and intertidal ecology study area were identified using a number of sources. These sources included the Defra magic map and the JNCC interactive map.
- Step 2: Information was compiled on the relevant features qualifying interests for each of these sites.
- Step 3: Using the above information and expert judgement, sites were included for further consideration if:
  - a designated site directly overlaps with the Transmission Assets; and
  - sites and associated qualifying interests were located within the potential ZOI for impacts associated with the Transmission Assets, with the ZOI determined through project specific outputs from the marine processes assessment (Volume 2, Chapter 1: Physical processes of the ES).

2.5.1.5 All other designated sites, including the MNRs around the Isle of Man, are outside the ZOI determined through project specific outputs from the marine processes assessment (Volume 2, Chapter 1: Physical processes of the ES and so will not be affected by the Transmission Assets. These sites have, therefore, not been considered further in this chapter.

Site specific surveys

2.5.1.6 To inform the ES, site-specific benthic subtidal and intertidal surveys were undertaken in the survey area (i.e. the Offshore Order Limits excluding the Generation Assets), as agreed with the JNCC, Natural England, NRW and Cefas. A summary of the surveys undertaken to inform the baseline assessment of the benthic subtidal and intertidal ecology impact assessment is outlined in **Table 2.6**. As outlined in **section 2.4**, the ES has also been informed by the site-specific benthic data collected for the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets and these surveys have also been added to **Table 2.6** for completeness.

Table 2.6: Summary of site-specific surveys

Survey type	Extent of survey	Overview of survey	Survey contractor	Date	Reference to further information
Benthic intertidal survey	The intertidal area (i.e. between MHWS and Mean Low Water Springs (MLWS)) at the proposed landfall location	Phase I walkover survey with on-site dig over macrofauna sampling to characterise the benthic environment at the landfall.	RPS	May 2022	Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES, with the intertidal survey results summarised in **section 2.6**.
Geophysical Survey	Geophysical survey of proposed offshore export cable route	Geophysical survey using multi-beam echo sounder, side scan sonar, magnetometer and sub-bottom profiler.	Gardline Ltd.	April 2022	Gardline, 2022, summarised in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.
Benthic subtidal survey	Transmission Assets survey area	Combined grab and drop down video (DDV) sampling within the survey area and five additional DDV-only stations within the Fylde MCZ.	Gardline Ltd.	April to August 2022	Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.

Survey type	Extent of survey	Overview of survey	Survey contractor	Date	Reference to further information
Benthic subtidal survey	Morgan Array Area	Combined grab and DDV sampling was undertaken at 35 sites and DDV sampling alone was undertaken at two sample sites. A total of 11 sediment samples from across the Morgan Array Areas within the benthic subtidal ecology study areas were analysed for sediment chemistry.	Gardline Ltd.	August to September 2021	(Morgan Offshore Wind Project Ltd., 2024b) Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Morgan Offshore Wind Project: Generation Assets ES
Benthic subtidal survey	Morgan Array Area and ZoI	Combined grab and DDV sampling at 26 stations. A total of 4 sediment samples from across the Morgan Array Area and 9 samples from across the Morgan Array Area ZoI within the benthic subtidal ecology study areas were analysed for sediment chemistry. Additionally two sample stations from the 2021 site specific surveys were re-sampled in 2022.	Gardline Ltd	April to July 2022	(Morgan Offshore Wind Project Ltd., 2024b) Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Morgan Offshore Wind Project: Generation Assets ES

Survey type	Extent of survey	Overview of survey	Survey contractor	Date	Reference to further information
Benthic subtidal survey	Morecambe Offshore Windfarm: Generation Assets	Samples from 50 stations, video footage at 47 stations and four transects across the surveyed area.	Ocean Ecology	February to March 2022	(Morecambe Offshore Windfarm Ltd, 2024a) Volume 5, Chapter 9 Benthic Ecology of the Morecambe Offshore Windfarm: Generation Assets ES

2.5.1.7 The site-specific benthic subtidal survey for the Transmission Assets was designed to sample evenly across the Transmission Assets at approximately 1.5-2 km intervals including within the Fylde MCZ. The combined grab sampling and DDV stations within the Fylde MCZ were not directly designed to resample the Fylde MCZ baseline survey (Miller and Green, 2017), but three of the additional five DDV only stations were chosen to re-survey stations originally sampled in the baseline survey for the site.

2.6 Baseline environment

2.6.1 Desk study

2.6.1.1 Information on benthic subtidal and intertidal ecology within the study area was collected through a detailed review of existing studies and datasets. These are summarised in **Table 2.5**.

2.6.1.2 The desk study baseline was informed by the site specific surveys undertaken for the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets. These are reported in the Morgan Offshore Wind Project: Generation Assets benthic technical report (Morgan Offshore Wind Ltd, 2024b) and the Morecambe Offshore Windfarm: Generation Assets (Morecambe Offshore Windfarm Ltd, 2024b). This information has been summarised below in **paragraphs 2.6.1.3** to **2.6.1.12** and is reported in full in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES. The technical reports for both the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets are also appended to Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.

Morgan Offshore Wind Project: Generation Assets

2.6.1.3 Site-specific benthic surveys were undertaken for the Morgan Offshore Wind Project: Generation Assets (which is encompassed within the Offshore Order Limits). These surveys in 2021 and 2022 were entirely within the Morgan Offshore Wind Project: Generation Assets Array Area (hereafter referred to as the Morgan Array Area) in 2021, and within this same area and within one tidal excursion in 2022. The 2021 surveys comprised sediment PSA, contaminant analysis, macrofaunal analysis and DDV at 35 stations within the Morgan Array Area, with two further DDV-only stations within the Morgan Array Area. The 2022 survey comprised 11 sample stations located within the Morgan Array Area and 15 sample stations located within the ZOI around the Morgan Array Area (defined as one tidal excursion around the Morgan Array Area, which partially overlaps with the areas of the Offshore Order Limits surrounding the east, west and south of the morgan Offshore Wind Project: Generation Assets), with all stations surveyed using combined grab and DDV sampling.

2.6.1.4 The sediments across Morgan Array Area and surrounding ZOI were dominated by sand and the average percentage sediment composition was 12.52% gravel, 79.53% sand and 7.95% mud. Sediments ranged from gravelly sand to muddy sandy gravel, with 36.51% of sample classified as gravelly sand, 30.16% of the samples classified as gravelly muddy sand, and 19.05% classified as sand (Morgan Offshore Wind Ltd, 2024b).

2.6.1.5 Levels of contamination were low across the Morgan Array Area and ZOI. Levels of arsenic at 17 sample stations (10 within the Morgan Array Area, and seven within the Morgan Array Area ZOI) marginally exceeded Canadian Threshold Effect Level (TEL) but were below the Canadian Probable Effect Level (PEL). Concentrations at three of these stations exceeded the Cefas Action Level 1 (AL1) but were below the Cefas Action Level 2 (AL2). Concentrations of all other metals were below the Cefas AL1 and the relevant Canadian TEL. Concentrations of polycyclic aromatic hydrocarbons (PAHs) in all samples were found to be below the respective TELs/PELs. No samples exceeded the Cefas AL1 or AL2 for polychlorinated biphenyls (PCBs). An explanation of the relevant thresholds is provided in volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.

2.6.1.6 The site-specific survey data showed that the benthic communities in the west and south sections of the Morgan Offshore Wind Project: Generation Assets were characterised by the polychaete-rich deep *Venus* community in offshore mixed sediments (SS.SMx.OMx.PoVen) biotope. The central area of the Morgan Offshore Wind Project: Generation Assets was characterised by circalittoral coarse sediment (SS.SCS.CCS) with a small area characterised by offshore circalittoral mixed sediment (SS.SMx.OMx). The east and most of the north edge of the Morgan Offshore Wind Project: Generation Assets were characterised by muddier sediments and the *Lagis koreni* and *Phaxas pellucidus* in circalittoral sandy mud (SS.SMu.CSaMu.LkorPpel) biotope. Further east in the Morgan Array Area ZOI, a broader circalittoral muddy sand biotope was prevalent (SS.SSa.CMuSa) which graded into communities characterised by the *Amphiura filiformis*, *Kurtiella bidentata* and *Abra nitida* in circalittoral sandy mud (SS.SMu.CSaMu.AfilKurAnit) biotope at the east edge of the Morgan Array Area ZOI, with these biotopes shown in Figure 2.5 (Volume 2, Figures).

2.6.1.7 No Annex I habitats were identified within the Morgan Offshore Wind Project: Generation Assets, although two stations of low resemblance stony Annex I reef were recorded to the south of the Morgan Offshore Wind Project: Generation Assets and located outside the Offshore Order Limits. Small pencil burrows were observed but no seapens were recorded. It was concluded that these areas had only a negligible resemblance to the 'seapen and burrowing megafauna communities' habitat but on a precautionary basis were assumed to represent this habitat.

Morecambe Offshore Windfarm: Generation Assets

2.6.1.8 The Morecambe Offshore Windfarm: Generation Assets, located to the west of the Transmission Assets, was surveyed in 2022, for PSA and macrofaunal sampling alongside DDV at 50 stations, with contaminant sampling at 20 of these stations.

2.6.1.9 Of the 50 stations surveyed, 27 sediment samples consisted of muddy sand (mS), seven of sand (S), eight of slightly gravelly sand ((g)S), six of slightly gravelly muddy sand ((g)mS), and one each of gravelly muddy sand (gmS) and sandy mud (sM). This resulted in a gradient across the Morecambe Offshore Windfarm: Generation Assets from less fine sediments in the west to finer sediments in the east.

2.6.1.10 Trace and heavy metal concentrations were overall low with none of the metals analysed exceeding any of the reference levels. In general metal concentrations were relatively higher to the east, closer to land than stations located further offshore. Arsenic was an exception to this trend as it exceeded the TEL at three stations; one to the west and two to the south of the Morecambe Offshore Windfarm: Generation Assets. However, arsenic concentrations never exceeded Cefas AL1.

2.6.1.11 PAH concentrations were compared to Cefas AL1 (no Cefas AL2 available for PAHs), OSPAR Background Assessment Concentration (BAC) levels and USA Environmental Protection Agency Effect Range Low (ERL), and TEL and PEL where possible. When compared to all of these, the only reference level to be exceeded was the BAC, with Pyrene and Naphthalene being above reference levels at six of the 20 stations sampled. However, when averaged across the wind farm site, none of the PAH concentrations exceeded any of the reference levels. In general PAHs showed higher concentrations at the nearshore stations compared to stations located further offshore, similar to what was observed for heavy and trace metals.

2.6.1.12 Analysis of the macrofaunal data indicated the presence of the SS.SMu.CSaMu.AfilKurAnit biotope in the east of the Morecambe Offshore Windfarm: Generation Assets, and *Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand (SS.SSa.CFiSa.ApriBatPo) biotope in the west of the Morecambe Offshore Windfarm: Generation Assets. No Annex I habitats were identified within the Morecambe Offshore Windfarm: Generation Assets, with this shown in Figure 2.5 (Volume 2, Figures).

2.6.2 Designated sites

2.6.2.1 All designated sites within the study area and qualifying interest features that could be affected by the construction, operation and maintenance, and decommissioning phases of the Transmission Assets are set out in **Table 2.7** and shown in Figure 2.2 (Volume 2, Figures).

Table 2.7: Designated sites and relevant qualifying interests

Designated site	Distance (km) to the Transmission Assets (nearest point)	Relevant qualifying interest
Liverpool Bay/Bae Lerpwl SPA	0	• Supporting habitat (for designated ornithological features).
Ribble and Alt Estuaries SPA	0	• Supporting habitat (for designated ornithological features).
Fylde MCZ	0	• Subtidal sand; and • subtidal mud.
Ribble Estuary SSSI	0	• Intertidal mudflats; and • intertidal sandflats.
Shell Flat and Lune Deep SAC	5.72	• Sandbanks which are slightly covered by sea water all the time; and • reefs.
West of Walney MCZ	5.85	• Subtidal sand; • subtidal mud; and • seapen and burrowing megafauna communities.
West of Copeland MCZ	6.32	• Subtidal coarse sediment; • subtidal sand; and • subtidal mixed sediment.

2.6.3 Site-specific surveys

Subtidal

Seabed sediments

2.6.3.2 Subtidal sediments recorded from infaunal grab samples collected across the survey area during the site-specific benthic subtidal surveys ranged from gravelly muddy sand to slightly gravelly sand with 42% of samples classified as muddy sand, 26% as sand, and 10% classified as gravelly muddy sand (Figure 2.3, see Volume 2, Figures). The coarseness of sediments generally increased with increasing distance from the coast, with sediments in the west of the survey area typically comprising gravelly muddy sands and gravelly sands. Sediments in the central area of the survey area were dominated by muddy sands and sandy muds, and in proximity to the landfall sediments were comprised of sands. According to the simplified Folk Classification (Long, 2006), most stations within the survey area were classified as sand and muddy sand (46%), with areas of mud and sandy mud (36%), mixed sediment (10%) and coarse sediment (8%).

2.6.3.3 The percentage sediment composition (i.e. mud ≤0.63 mm; sand <2 mm; gravel ≥2 mm) at each grab sample station in the survey area was also determined. Across all sample stations in the survey area, the average percentage sediment composition was 3.32% gravel, 76.8% sand and 19.88% fines and mud, with sand making up the highest proportion of the sediment composition. Sediments across the survey assets were typically very poorly sorted (51% of samples). Of the other samples, 26% were classified as poorly sorted and 7% were classified as moderately well sorted.

Sediment contamination

2.6.3.4 As part of the contamination analysis of subtidal sediment samples collected within the survey area, levels of heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), PAHs and PCBs were identified and compared to Cefas AL1 and AL2 as well as the Canadian Environmental Quality Guidelines (i.e. PEL and TEL). In summary, no contaminants were found to exceed Cefas AL2 or the PEL. The most prevalent metal contaminant recorded in the sediments was arsenic, which was present in concentrations exceeding the TEL at 17 sites, but all were below Cefas AL1. Concentrations of nickel at a single station located offshore in the north of the Offshore Order Limits and immediately east of the Morgan Offshore Wind Project: Generation Assets marginally exceeded the Cefas AL1 but were well below the Cefas AL2. Sediments at seven sites, mostly within the central section of the survey area, exceeded the Canadian TEL for mercury but all were below the Cefas AL1.

2.6.3.5 Detectable levels of PCBs were only recorded in sediments at 13 stations, the majority of which were in the nearshore part of the survey area approaching the landfall. However, levels of PCBs, for all samples, were found to be below all available Cefas AL1s. The levels of the total ICES-7 PCBs were below the relevant Cefas AL1 threshold at all stations, and total PCBs were below the Cefas AL1 and Cefas AL2 at all stations.

2.6.3.6 On the whole, levels of PAHs were low. Levels of all individual PAHs were below the Cefas AL1 for individual PAHs. For dibenzo[ah]anthracene, which has a lower Cefas AL1, concentrations in all samples were below this more conservative threshold with the exception of a single station (ENV097) where levels of dibenzo[ah]anthracene marginally exceeded this threshold. Concentrations of individual PAHs were also well below their respective ERL values. The total PAHs per station were also below the ERL threshold for total PAHs indicating that toxic effects to fauna by PAHs are unlikely.

Biotopes and habitats

2.6.3.7 Across the survey area, the infaunal communities were generally dominated by annelids (40.71% of all individuals) and molluscs (28.34% of all individuals). The most abundant individual taxon was the mollusc *Kurtiella bidentata* with a total of 4,467 individuals recorded. The biomass was dominated by echinoderms (44.4% of all biomass) such as *Ophiura ophiura* alongside molluscs (40.28% of all biomass) such as *K. bidentata* and to a lesser extent annelids (12.5% of all biomass) such as *Nephtys* sp.

2.6.3.8 The epifaunal communities recorded by the seabed imagery varied according to the type of sediment. In general, higher numbers of epifaunal species were recorded in association with the coarser sediments. Epifaunal communities were dominated by echinoderms, primarily brittlestars *O. ophiura* at 81 stations, and common epifaunal species such as *Alcyonium digitatum* at many stations, with relatively low numbers of molluscs such as *Abra alba* or *Phaxas pellucidus*. Stations in areas of coarse and mixed sediments recorded a range of taxa including Serpulidae, *A. digitatum* and Pectinidae.

2.6.3.9 A full description of the habitats and biotopes recorded in the site-specific benthic surveys in the survey area, including full descriptions of the biotope codes discussed in this section and shown in Figure 2.4 (Volume 2, Figures), are provided in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES. Figure 2.5 (Volume 2, Figures) shows these Transmission Assets biotopes alongside the biotopes from the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets site-specific surveys.

2.6.3.10 The biotopes recorded within the survey area are shown in Figure 2.4 (Volume 2, Figures) and were determined through a combination of the site-specific macrofaunal grab data and the DDV data. The SS.SMu.CSaMu.AfilKurAnit dominated the centre of the survey area and was the most common biotope recorded, at 26 stations. This biotope is characterised by communities of abundant echinoderms and molluscs in sandy mud, although with relatively low species richness overall. The north of the survey area (to the east of the Morgan Offshore Wind Project: Generation Assets), and patches of the south of the survey area, were dominated by the *Lagis koreni* and *Phaxas pellucidus* in circalittoral sandy mud (SS.SMu.CSaMu.LkorPpel) biotope. This biotope was characterised by polychaetes including *L. koreni*, *Scalibregma inflatum*, and *Sthenelais limicola*.

2.6.3.11 The west of the survey area, along the west boundary of the Morgan Offshore Wind Project: Generation Assets, was dominated by the SS.SMx.OMx.PoVen biotope. The biotope was characterised by a diverse community rich in polychaetes potentially with a significant venerid bivalve component. In the area of the survey area located to the north west of the Morecambe Offshore Windfarm: Generation Assets, the underlying sediment changed to fine sands and mixed sediments, characterised by the SS.SMx.CMx.KurThyMx biotope and the

Echinocyamus pusillus, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand SS.SSa.CFiSa.EpusOborApri biotope, respectively.

2.6.3.12 In the nearshore area the subtidal communities associated with the sand and muddy sand sediments were characterised by the *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment (SS.SSa.CMuSa.AalbNuc) biotope and infralittoral fine sand (SS.SSa.IFiSa) interspersed with SS.SSa.CMuSa.AalbNuc, approaching the landfall.

2.6.3.13 The epifaunal analysis indicated a broad alignment with the infaunal biotopes, with the DDV-only stations within the Fylde MCZ being classified as SS.SSa.CMuSa. In the north of the Transmission Assets, to the north east of the Morgan Offshore Wind Project: Generation Assets, a single station was classified as *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment SS.SMx.CMx.OphMx, with full details of these classifications provided in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.

Habitat assessment

2.6.3.14 Several seabed habitats were taken forward for further assessment to determine their potential to align with features of conservation habitats.

2.6.3.15 Sandy sediments in less than 20 m of water occur within the survey area. Nearshore stations (ENV154 to ENV168) were within 10 km of the Shell Flat and Lune Deep SAC which is designated for Annex I sandbanks which are slightly covered by sea water all the time. Assessment of the site-specific geophysical data revealed dunes to be present and the seabed intermittently shoaled to less than 20 m Lowest Astronomical Tide. However, these areas were interpreted as shoulders of a deeper channel rather than a sandbank. Therefore, recognised areas of sandy sediments in water depths of less than 20 m Lowest Astronomical Tide within the survey area in the Offshore Order Limits were considered unlikely to qualify as a Habitats Directive Annex I ‘sandbanks which are slightly covered by seawater all of the time’ habitat. Further detail on this Annex I sandbank feature and the full justification for the sandbanks within the survey area not qualifying as this Annex I feature is presented in Volume 2, Chapter 1: Physical Processes of the ES.

2.6.3.16 No Annex I reefs (biogenic or geogenic) were recorded within the survey area.

2.6.3.17 Across the survey area, small pencil burrows were observed at 22 stations. Although no seapens were observed, the JNCC (2014) guidance stipulates that ‘seapen and burrowing megafauna communities’ habitat can occur without the occurrence of seapens. As a result, an analysis of this habitat was undertaken by determining the density of burrows and their abundance which was then categorised using the SACFOR (Superabundant, Abundant, Common, Frequent, Occasional and Rare) abundance scale.

2.6.3.18 The density of burrows varied from 0.004 burrows per m^2 in the north west of the survey area (ENV080) to 6.18 burrows per m^2 in the south of the survey area, directly to the east of the Morecambe Offshore Windfarm: Generation Assets (ENV125). The majority of burrows were <1 cm in size. Burrow abundance was identified as being ‘common’ at six stations close to the nearshore, and ‘frequent’ at five stations throughout the survey area. Whilst the relatively low abundance of burrows overall were not consistent with a confident classification as the ‘seapen and burrowing megafauna communities’ habitat as defined by OSPAR, a precautionary approach has been adopted which has assumed the presence of burrows to correspond to the presence of this habitat and SS.SMu.CFiMu.SpnMeg biotope as shown in Figure 2.4 (Volume 2, Figures).

2.6.3.19 Evidence of hard substrate Porifera species was observed at 12 stations throughout the survey area, but the density was typically <1% of each image, with specimens being individuals encrusting lone *Pectinidae* shells. No stations were considered to represent the fragile sponge and anthozoan communities on subtidal rocky habitat.

Intertidal

Sediments

2.6.3.20 The results of the Phase 1 intertidal survey (completed in May 2022) are presented in Figure 2.6 (Volume 2, Figures). The landfall contained expansive gently sloping exposed sandflats which dissipated the wave energy associated with incoming tides. A breaker zone was present in the lower shore with well-developed surf and swash zones in the mid shore. The mid-section of the beach was dominated by wide mobile sandbars comprised mainly of fine to medium grained sand, with small amounts of large shell fragments and gravels, and supported a low density of fauna. Typically, three large parallel sandbars occurred at any transect line down the mid-shore. Troughs lay between sandbars and contained a fine-grained sand with a slightly higher mud content. The lowest part of the shore was comprised predominantly of fine to medium sand and although the mud content was relatively low it was highest in this location.

Biotopes and habitats

2.6.3.21 The narrow strip of medium to coarse sands and pebbles at the top of the shore were associated with moderate populations of amphipods under decomposing seaweed and vascular plant-based detritus along the strandline typical of the talitrids on upper shore and strandline (LS.LSa.St.Tal) biotope.

2.6.3.22 The upper mid-shore was characterised by the biotope polychaete/amphipod-dominated fine sand shores (LS.LSa.FiSa), with the biotope barren or amphipod dominated mobile sand (LS.LSa.MoSa) present on sandbars intersecting troughs in the mid-shore leading into the low shore. These waterlogged troughs were characterised by polychaete/bivalve-dominated muddy sand shores (LS.LSa.MuSa) biotope and low densities of *A. marina*, and a range of biota including *Cerastoderma edule* and *Acanthocardia echinata*.

2.6.3.23 The *Macoma balthica* and *Arenicola marina* in littoral muddy sand (LS.LSa.MuSa.MacAre) biotope was present along the lower shore, and to a limited extent in the mid-shore, with *A. marina* replaced by *A. defodiens* at low water. These were present alongside other species including *Lanice conchilega*, *Pygospio elegans* and *Hediste diversicolor*. Across the lower shore, the biotope *Lanice conchilega* in littoral sand (LS.Lsa.MuSa.Lan) was present in a mosaic alongside high densities of *Echinocardium cordatum* which contributed to the biotope *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand (SS.SSa.IMuSa.EcorEns) as shown in Figure 2.6 (Volume 2, Figures).

2.6.4 Future baseline conditions

2.6.4.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 require that "*an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge"* is included within the ES. This section provides an outline of the likely future baseline conditions in the absence of the Transmission Assets.

2.6.4.2 Further to potential change associated with existing cycles and processes, it is necessary to take account of potential effects of climate change on the marine environment. Variability and long-term changes on physical influences may bring direct and indirect changes to benthic habitats and communities in the mid to long term future (UK Offshore Energy Strategic Environmental Assessment 3) (Department of Energy and Climate Change, 2016).

2.6.4.3 A strong base of evidence indicates that long term changes in the benthic ecology may be related to long term changes in the climate or in nutrient availability and supply (Department of Energy and Climate Change, 2016), with climatic processes driving shifts in benthic community abundances and species composition. Benthic communities are also currently being influenced by anthropogenic activities including contamination or seabed-disturbing activities such as trawling, dredging and infrastructure installation. These are further detailed in Volume 2, Chapter 6: Commercial fisheries of the ES; Volume 2, Chapter 7: Shipping and navigation of the ES, and Volume 2, Chapter 9: Other sea users of the ES.

2.6.4.4 Studies of benthic ecology over the last three decades have shown that biomass has increased by at least 250% to 400%; opportunistic and short-lived species have increased; and long-living sessile animals have decreased (Krönke, 1995; Krönke, 2011). The Marine Climate Change Impacts Partnership Annual Report Card 2007-2008 Scientific Review - Seabed Ecology (MCCIP, 2008) concluded that the available data show that climatic processes, both directly, e.g. winter mortality, and indirectly, via hydrographic conditions, influence the abundance and species composition of sea bed communities. The alteration in the seafloor communities could alter rates and timing of processes such as nutrient cycling, larval supply to the plankton and organic waste assimilation. Defra's recent focus on the risk of climate change to ecosystem services (HM Government, 2022) focuses on INNS and their likely detriment to native communities and ecosystems, the increased risk to species as their distributions shift of disease from new pathogens, and the impacts on areas of high biodiversity value in the coastal zone from increased storms and erosion. Defra also highlight the risks associated with ocean acidification and higher water temperatures which are linked to climatic changes (HM Government, 2022).

2.6.5 Key receptors

2.6.5.1 In accordance with the best practice guidelines for ecological impact assessment in the UK and Ireland (CIEEM, 2022), for the purposes of the benthic subtidal and intertidal ecology EIA, IEFs have been identified. The potential impacts of the Transmission Assets which have been scoped into the assessment have been assessed against the IEFs to determine whether or not they are significant. The IEFs assessed are those that are considered to be important and potentially affected by the Transmission Assets. It should be noted that the IEFs assessed include those identified during the site-specific surveys for the Transmission Assets within the survey area (as described in **section 2.6.3**) together with the IEFs identified within the Generation Assets (as described in **section 2.6.1**). Importance may be assigned due to quality or extent of habitats, habitat or species rarity or the extent to which they are threatened (CIEEM, 2022). Species and habitats are considered IEFs if they have a specific biodiversity importance recognised through international or national legislation or through local, regional, or national conservation plans (e.g. Annex I habitats under the Habitats Directive, OSPAR, National Biodiversity Plan or the Marine Strategy Framework Directive).

2.6.5.2 **Table 2.8** identifies the receptors taken forward into the assessment as IEFs and agreed with stakeholders through the consultation process, as presented in **section 2.3.**

Table 2.8: Key receptors taken forward to assessment

IEF	Description and representative biotopes	Location	Protection status/ Conservation interest	Importance within the study area
Subtidal habitats				
Subtidal coarse and mixed sediments with diverse benthic communities.	Subtidal coarse and mixed sediments characterised by diverse communities of polychaetes, bivalves and mobile crustaceans identified throughout the Offshore Order Limits. • SS.SCS.CCS (within survey area and the Morgan Offshore Wind Project: Generation Assets). • SS.SMx.OMx (within Morgan Offshore Wind Project: Generation Assets). • SS.SMx.OMx.PoVen (across survey area and within Morgan Offshore Wind Project: Generation Assets). • SS.SMx.CMx.KurThyMx (within the survey area). • SS.SMx.CMx.	Within the Offshore Order Limits (and within the Morgan Offshore Wind Project: Generation Assets)	Habitats of Principal Importance in England. Habitats listed as Features of Conservation Interest. UK Biodiversity Action Plan (BAP) priority habitat.	National
Brittlestar beds	Subtidal mixed sediment dominated by brittlestars which form dense beds. • SS.SMx.CMx.OphMx.	Within the Offshore Order Limits (north east of the Morgan Offshore Wind Project: Generation Assets)	UK BAP priority habitat Habitat of Principal Importance in England (NERC Act 2006)	National
Subtidal muddy sands with relatively species poor benthic communities	Subtidal muddy sands characterised by bivalves, polychaetes, and potential seapen and burrowing megafauna. • SS.SMu.CSaMu.LkorPpel (within survey area and the Morgan Offshore Wind Project: Generation Assets). • SS.SMu.CSaMu.AfilKurAnit (across the survey area and the Morecambe Offshore Windfarm: Generation Assets). • SS.SMu.CMuSa (within the survey area).	Within the Offshore Order Limits (and within the Morecambe Offshore Windfarm: Generation Assets)	Habitats of Principal Importance and Habitats of Conservation Interest in England and Wales.	National
Subtidal sandy sediments characterised by	Subtidal sandy sediments characterised by echinoderms, polychaetes and bivalves.	Within the Offshore Order Limits (and within	Habitats of Principal	National

IEF	Description and representative biotopes	Location	Protection status/ Conservation interest	Importance within the study area
relatively diverse infaunal and epifaunal benthic communities	• SS.SSa.CFiSa.EpusOborApri (across the survey area and the Morecambe Offshore Windfarm: Generation Assets). • SS.SSa.CMuSa.AalbNuc (across the survey area). • SS.SSa.IFiSa (across the survey area near the landfall). • SS.SSa.CFiSa (across the survey area near the landfall). • SS.SSa.CFiSa.ApriBatPo (within the Morecambe Offshore Windfarm: Generation Asset).	the Morgan Offshore Wind Project: Generation Assets)	Importance in England. Habitats listed as Features of Conservation Interest. UK BAP priority habitat.	
Annex I low resemblance stony reef (outside an SAC)	Cobbles and boulders with indicator species such as *A. digitatum*, *Nemertesia* sp. and *Tubularia* sp. Identified to the south of the Morgan Offshore Wind Project: Generation Assets. • CR.HCR.XFa.SpNemAdia (within the Morgan Offshore Wind Project: Generation Assets ZOI)	Within the wider study area (i.e. outside the Offshore Order Limits)	Potential Annex I habitat outside an SAC.	National
Seapens and burrowing megafauna communities	Plains of fine mud at depths greater than about 15 m may be heavily bioturbated by burrowing megafauna (no seapens recorded in the survey area). • SS.SMu.CFiMu.SpnMeg	Within Offshore Order Limits (within the Morecambe Offshore Windfarm: Generation Assets and to the east and north east of this)	UK BAP priority habitat OSPAR habitat Habitat of Principal Importance in England (NERC Act 2006)	National
Annex I habitat features of SACs				
Sandbanks which are slightly covered by sea water all the time	Sandbanks slightly covered in sea water at all times typically characterised by mobile epifauna including molluscs and crustaceans, and foliose seaweeds, hydroids and bryozoans where sediment is more stable. Shell Flat and Lune Deep SAC: • SS.SSa.CMuSa.AalbNuc. • SS.SSa.IMuSa.FfabMag. • SS.SMu.ISaMu.KurAbr.	Within wider study area (i.e. outside the Offshore Order Limits)	Annex I Habitats Directive. Annex I qualifying feature of the Shell Flat and Lune Deep SAC.	International

IEF	Description and representative biotopes	Location	Protection status/ Conservation interest	Importance within the study area
Reefs	Subtidal rocky marine habitats or biological concretions arising from the seabed, typically characterised by diverse invertebrate and algal communities. • CR.HCR.XFa.FluCoAs.X. • CR.HCR.XFa.FluHocu.	Within wider study area (i.e. outside the Offshore Order Limits)	Annex I Habitats Directive. Annex I qualifying feature of the Shell Flat and Lune Deep SAC.	International
Broadscale habitats: features of MCZs				
Subtidal mud	Fylde MCZ – designated for subtidal muds which are known to support diverse bivalve and polychaete communities. • SS.SMu.CSaMu.AfilKurAnit • SS.SSa.CMuSa.AalbNuc • SS.SSa.CMuSa (confirmed by DDV only surveying within the survey area) • SS.SSa.IMuSa.EcorEns • SS.SMu.CSaMu.LkorPpel West of Walney MCZ–- Muds and sandy muds in extremely sheltered areas with very weak tidal currents. High numbers of polychaetes, bivalve and echinoderms such as urchins and brittle stars. • SS.SMu.CSaMu.AfilKurAnit.	Fylde MCZ: within both study area and Offshore Order Limits West of Walney MCZ: within wider study area (i.e. outside the Offshore Order Limits)	UK BAP priority habitat Protected feature of: • Fylde MCZ; and • West of Walney MCZ.	National
Subtidal sand	Fylde MCZ – designated for subtidal sands with associated polychaete, amphipod and bivalve communities. • SS.SSa.CMuSa.AalbNuc. • SS.SCS.ICS.MoeVen. • SS.SCS.ICS.Glap. West of Walney MCZ– Sand seascapes with infaunal polychaetes and bivalves. • SS.SMu.CSaMu.AfilKurAnit. • SS.SMx.CMx.KurThyMx. West of Copeland MCZ – Sand seascapes with infaunal polychaetes and bivalves.	Fylde MCZ: within both study area and Offshore Order Limits West of Walney MCZ and West of Copeland MCZ: Within wider study area (i.e. outside the Offshore Order Limits)	UK BAP priority habitat Protected feature of: • Fylde MCZ; • West of Walney MCZ; and • West of Copeland MCZ.	National

IEF	Description and representative biotopes	Location	Protection status/ Conservation interest	Importance within the study area
	• SS.SMu.CSaMu.AfilKurAnit.			
Subtidal coarse sediment	Coarse sand and gravel or shell fragments. Largely characterised by infaunal communities include bristleworms, sand mason worms, burrowing anemones and bivalves. • SS.SCS.CCS[1]	Within wider study area (i.e. outside the Offshore Order Limits)	UK BAP priority habitat. Protected feature of the West of Copeland MCZ.	National
Subtidal mixed sediment	A range of different types of sediments. Animals found here include worms, bivalves, starfish and urchins, anemones, sea firs and sea mats. • SS.SMx.OMx. • SS.SMx.OMx.PoVen.	Within wider study area (i.e. outside the Offshore Order Limits)	Protected feature of the West of Copeland MCZ.	National
Seapens and burrowing megafauna communities	Fine mud heavily bioturbated by burrowing megafauna; burrows and mounds may form a prominent feature with conspicuous populations of seapens, typically *Virgularia mirabilis* and *Pennatula phosphorea*. • SS.SMu.CFiMu.SpnMeg	Within wider study area (i.e. outside the Offshore Order Limits)	OSPAR habitat, UK BAP priority habitat. Protected feature of the West of Walney MCZ.	National
Intertidal habitats				
Species poor/barren sands	Clean mobile free draining sand in the middle shore. Amphipods were recorded sparsely or containing spionid polychaete worms and amphipods. • LS.LSa.FiSa. • LS.LSa.MoSa.	Intertidal within the Intertidal Infrastructure Area	UK BAP priority habitat. Annex I habitat outside an SAC Feature of the Ribble Estuary SSSI.	National
Polychaete/ bivalve-dominated muddy sand shores	Large areas of the middle shore contained muddy fine grained waterlogged sand. Several species of bivalve molluscs were observed including *Macomangulus tenuis*. Polychaetes included *Arenicola marina*, and *L. conchilega.* • LS.LSa.MuSa. • LS.LSa.MuSa.MacAre. • LS.LSa.MuSa.Lan.	Intertidal zone within the Intertidal Infrastructure Area	UK BAP priority habitat Annex I habitat outside an SAC. Feature of the Ribble Estuary SSSI.	National
Echinocardium cordatum and *Ensis* spp. in lower shore and	Dense populations of the heart urchin *Echinocardium cordatum* in fine sand at the lower shore accompanied by occasional	Intertidal zone within the Intertidal	UK BAP priority habitat Annex I habitat outside an SAC	National

IEF	Description and representative biotopes	Location	Protection status/ Conservation interest	Importance within the study area
shallow sublittoral slightly muddy fine sand	*Ensis siliqua* and *Lanice conchilega*. • SS.SSa.IMuSa.EcorEns.	Infrastructure Area	Feature of the Ribble Estuary SSSI	

[1]This biotope was not present in the MarESA therefore SS.SCS.CCS.MedLumVen biotope has been used as a proxy for sensitivity.

2.7 Scope of the assessment

2.7.1.1 The scope of this ES has been developed in consultation with relevant statutory and non-statutory consultees as detailed in **Table 2.4**. The assessment encompasses all stages of the Transmission Assets including those associated with seabed disturbance during the construction and operation and maintenance phases as well as those associated with the physical presence of infrastructure.

2.7.1.2 Taking into account the scoping and consultation process, **Table 2.9** summarises the impacts considered as part of this assessment.

Table 2.9: Impacts considered within this assessment

Activity	Impacts scoped into the assessment
Construction phase	
Seabed preparation activities (i.e. boulder and sandwave clearance) Offshore export cable installation including anchor placements Installation of the offshore export cable at the landfall Removal of disused cables	Temporary habitat loss/disturbance. Increased SSCs and associated sediment deposition. Disturbance/remobilisation of sediment-bound contaminants. Long term habitat loss. Introduction of artificial structures. Increased risk of introduction and spread of INNS.
Operation and maintenance phase	
Presence of cable protection Cable reburial Cable repair	Temporary habitat loss/disturbance. Increased SSC and associated deposition. Disturbance/remobilisation of sediment-bound contaminants. Introduction of artificial structures. Long term habitat loss. Increased risk of introduction and spread of INNS. Changes in physical processes. Impacts to benthic invertebrates due to EMF. Heat from subsea electrical cables.
Decommissioning phase	

Activity	Impacts scoped into the assessment
Removal of offshore export cables.	Temporary habitat loss/disturbance. Increased SSC and associated deposition. Disturbance/remobilisation of sediment-bound contaminants. Long term habitat loss (assessed as permanent habitat loss when infrastructure is left *in situ*). Introduction of artificial structures. Increased risk of introduction and spread of INNS. Removal of hard substrates. Changes in physical processes.

2.7.1.3 Impacts that are not likely to result in significant effects have been scoped out of the assessment. A summary of the effects scoped out, together with justification for scoping them out and whether the approach has been agreed with key stakeholders through either scoping or consultation, is presented in **Table 2.10**.

Table 2.10: Impacts scoped out of the assessment

Impacts	Justification
Accidental pollution during construction, operation and maintenance and decommissioning	There is a risk of pollution being accidentally released during the construction, operation and maintenance and decommissioning phases from sources including vessels or vehicles and equipment or machinery. However, the risk of such events is managed by the implementation of measures set out in standard post-consent plans (Outline Offshore EMP (for application, CoT65, **Table 2.11**), including a MPCP). These plans involve methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme for activities carried out below MHWS. Therefore, the likelihood of an accidental spill occurring is very low and in the unlikely event that such events occur, the magnitude of these will be minimised through the outlined measures and plans, such that no significant effect would occur. As such, this impact was scoped out of further consideration within the ES. The Planning Inspectorate and the MMO agreed through their scoping responses that the impact of accidental pollution could be scoped out of the assessment, as noted in **Table 2.4**.

2.8 Measures adopted as part of the Transmission Assets (Commitments)

2.8.1.1 For the purposes of the EIA process, the term 'measures adopted as part of the Transmission Assets' is used to include the following types of mitigation measures (adapted from Institute for Environmental Management and Assessment (IEMA, 2016)). These measures are set out in Volume 1, Annex 5.3: Commitments Register of the ES.

- Embedded mitigation. This includes the following.
  - Primary (inherent) mitigation - measures included as part of the project design. IEMA describes these as 'modifications to the location or design of the development made during the pre-application phase that are an inherent part of the project and do not require additional action to be taken'. This includes modifications arising through the iterative design process. These measures will be secured through the consent itself through the description of the project and the parameters secured in the DCO and/or marine licences. For example, a reduction in footprint or height.
  - Tertiary (inexorable) mitigation. IEMA describes these as 'actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects'. It may be helpful to secure such measures through a Code of Construction Practice or similar.
- Secondary (foreseeable) mitigation. IEMA describes these as '*actions that will require further activity in order to achieve the anticipated outcome'*. These include measures required to reduce the significance of environmental effects (such as lighting limits) and may be secured through an EMP.

2.8.1.2 The measures relevant to this chapter are summarised in **Table 2.11**.

2.8.1.3 Embedded measures that will form part of the final design (and/or are established legislative requirements/good practice) have been taken into account as part of the initial assessment presented in section 2.11 below (i.e., the initial determination of impact magnitude and significance of effects assumes implementation of these measures). This ensures that the measures that the Applicants are committed to are taken into account in the assessment of effects. Where an assessment identifies likely significant adverse effects, further or secondary mitigation measures may be applied. These are measures that could further prevent, reduce and, where possible, offset these effects. They are defined by IEMA as actions that will require further activity in order to achieve the anticipated outcome and may be imposed as part of the planning consent, or through inclusion in the ES (referred to as secondary mitigation measures in IEMA, 2016). For further or secondary measures both pre-mitigation and residual effects are presented.

Consideration of mitigation hierarchy

2.8.1.4 A key element of the development of the Transmission Assets project description (Volume 1, Chapter 3: Project description of the ES) has been the consideration of the mitigation hierarchy which provides clear steps regarding how to minimise the impact of a project on the natural environment. The first stage of the mitigation hierarchy involves the implementation of measures to avoid impacts from the outset (e.g. avoiding designated sites and sensitive habitats through initial project design. Where impacts cannot be completely avoided, the second stage of the mitigation hierarchy requires that measures are taken to reduce the magnitude of the impact on the designated site/habitats (e.g. through refinement/reduction of project parameters). The third stage is to remediate/restore habitats affected by impacts to reduce, as far as possible, the residual impacts that a project has on a designated site/feature. As a last resort, the mitigation hierarchy states that compensation for any residual harm should be undertaken through habitat creation or restoration. Full details on how these have been applied to reduce impacts on designated sites including the Fylde MCZ have been presented in the MCZ Assessment and Stage 1 Assessment Report (document reference: E4).

Table 2.11: Measures (commitments) adopted as part of the Transmission Assets

Commitment number	Measure adopted	How the measure will be secured
Embedded measures		
CoT19	All trenchless crossings will be undertaken by non-impact methods such as HDD (or other trenchless techniques including micro tunnelling and direct pipe), excluding preparatory works, in order to minimise construction noise and vibration beyond the immediate location of works.	DCO Schedules 2A & 2B, Requirement 8 (Code of Construction Practice).
CoT44	The Project Description (Volume 1, Chapter 3 of the Environmental Statement) sets out that the installation of the offshore export cables under Lytham St Annes SSSI and the St Annes Old Links Golf Course will be undertaken by direct pipe trenchless installation technique. The exit pits associated with the direct pipe installation will be at least 100 m seaward of the west boundary of the SSSI.	DCO Schedules 2A & 2B, Requirement 8 (Code of Construction Practice).
CoT45	An Outline Offshore CSIP (document reference J15) for the Fylde MCZ includes: details of cable burial depths, cable protection, cable monitoring. The Outline CSIP also includes an Outline Cable Burial Risk Assessment (CBRA) (document reference J14). Detailed CSIP(s) and CBRA(s) will be prepared by the Applicants covering the full extent of their respective offshore export cable corridors. Detailed CSIPs will be developed in accordance with the Outline CSIP and will ensure safe navigation is not compromised including consideration of under keel clearance. No more than 5% reduction in water depth (referenced to Chart Datum) will occur at any point on the offshore export cable corridor route without prior written approval from the Maritime and Coastguard Agency (MCA).	DCO Schedule 14 (Marine Licence 1: Morgan Offshore Wind Project Transmission Assets) Part 2 - Condition18(1)(e) (Pre-construction plans and documentation) and DCO Schedule 15 (Marine Licence 2: Morecambe Offshore Wind Farm Transmission Assets), Part 2 - Condition 18(1)(e) (Pre-construction plans and documentation).
CoT47	The Outline Offshore CSIP (document reference J15) includes measures to limit the extent of cable protection to 3% of the offshore export cable route within the Fylde MCZ (excluding cable crossings). Within the Fylde MCZ, external cable protection will only be used where deemed to be essential, e.g. for cable crossings or in the instance that adequate burial / reburial is not possible for any section of the route through the Fylde MCZ. The Outline CSIP also includes measures to limit sandwave clearance to up to 5% of the offshore export cable corridor route within the Fylde MCZ. Material arising from sandwave clearance in the Fylde MCZ will be deposited within the Fylde MCZ. The requirements for cable protection and sandwave clearance will be informed through the undertaking of survey works pre-construction. Detailed CSIP(s) will be developed in accordance with the Outline Offshore CSIP (document reference J15).	DCO Schedule 14 (Marine Licence 1: Morgan Offshore Wind Project Transmission Assets) Part 2 - Condition18(1)(e) (Pre-construction plans and documentation) and DCO Schedule 15 (Marine Licence 2: Morecambe Offshore Wind Farm Transmission Assets), Part 2 - Condition 18(1)(e) (Pre-construction plans and documentation).

Commitment number	Measure adopted	How the measure will be secured
CoT49	Construction Method Statement(s) (CMSs) including Offshore Cable Specification and Installation Plan(s), will be produced and implemented prior to construction. These will contain: • details of cable installation and methodology; and • details of foundation installation methodology covering scour protection and the deposition of material arising from drilling, dredging, and/or sandwave clearance.	DCO Schedule 14 (Marine Licence 1: Morgan Offshore Wind Project Transmission Assets) Part 2 - Condition18(1)(e) (Pre-construction plans and documentation) and DCO Schedule 15 (Marine Licence 2: Morecambe Offshore Wind Farm Transmission Assets), Part 2 - Condition 18(1)(e) (Pre-construction plans and documentation).
CoT54	An Outline Offshore CSIP (document reference J15) includes for cable burial to be the preferred option for cable protection, where practicable. Detailed CSIP(s) will be developed in accordance with the Outline Offshore CSIP.	DCO Schedule 14 (Marine Licence 1: Morgan Offshore Wind Project Transmission Assets) Part 2 - Condition18(1)(e) (Pre-construction plans and documentation) and DCO Schedule 15 (Marine Licence 2: Morecambe Offshore Wind Farm Transmission Assets), Part 2 - Condition 18(1)(e) (Pre-construction plans and documentation).
CoT64	Detailed Marine Mammal Mitigation Protocols (MMMPs) will be developed and implemented in accordance with the Outline MMMP (document reference J18), to reduce the risk of injury to marine mammals. The Detailed MMMP(s) will include measures to apply in advance of and during UXO clearance. The Detailed MMMP(s) will include for the use of low order techniques, where possible, as the primary mitigation measure alongside other measures. The detailed MMMP(s) will be approved by Marine Management Organisation, in consultation with Natural England.	DCO Schedule 14 (Marine Licence 1: Morgan Offshore Wind Project Transmission Assets) Part 2 – Condition 20(1)(b) (UXO clearance) and DCO Schedule 15 (Marine Licence 2: Morecambe Offshore Wind Farm Transmission Assets), Part 2 - Condition20(1)(b) (UXO clearance).

Commitment number	Measure adopted	How the measure will be secured
CoT65	An Offshore EMP will be developed and will include details of: – a MPCP to address the risks, methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme for activities carried out below MHWS; – a chemical risk review to include information regarding how and when chemicals are to be used, stored and transported in accordance with recognised best practice guidance; – waste management and disposal arrangements; – the appointment and responsibilities of a fisheries liaison officer; – a fisheries liaison and coexistence plan (which accords with the outline fisheries liaison and co-existence plan) to ensure relevant fishing fleets are notified of commencement of licensed activities pursuant to condition and to address the interaction of the licensed activities with fishing activities; – measures to minimise disturbance to marine mammals and rafting birds from vessels; and – measures to minimise the potential spread of invasive non-native species, including adherence to IMO ballast water management guidelines.	DCO Schedule 14 (Marine Licence 1: Morgan Offshore Wind Project Transmission Assets) Part 2 - Condition18(1)(f) (Pre-construction plans and documentation) and DCO Schedule 15 (Marine Licence 2: Morecambe Offshore Wind Farm Transmission Assets), Part 2 - Condition18(1)(f) (Pre-construction plans and documentation).
CoT90	The Project Description (Volume 1, Chapter 3 of the Environmental Statement) sets out that the installation of the 400kV Grid Connection Cable Corridor beneath the River Ribble will be undertaken by direct pipe or micro tunnel trenchless installation techniques.	DCO Schedules 2A & 2B, Requirement 5(3)(Detailed design parameters onshore) and Requirement 8 (Code of Construction Practice).
CoT108	The Outline Offshore CSIP (document reference J15) submitted as part of the application for development consent, includes for all external cable protection used within the Fylde MCZ to be designed to be removable on decommissioning. Detailed CSIP(s) will be developed in accordance with the Outline Offshore CSIP.	DCO Schedule 14 (Marine Licence 1: Morgan Offshore Wind Project Transmission Assets) Part 2 - Condition18(1)(e) (Pre-construction plans and documentation) and DCO Schedule 15 (Marine Licence 2: Morecambe Offshore Wind Farm Transmission Assets), Part 2 - Condition18(1)(e) (Pre-construction plans and documentation).

Commitment number	Measure adopted	How the measure will be secured
CoT109	The requirement for removal of cable protection within the Fylde MCZ will be agreed with stakeholders and regulators at the time of decommissioning. Removal of cable protection will be in accordance with the Offshore Decommissioning Programme.	DCO Schedule 2A Requirement 21 (Offshore decommissioning) and DCO Schedule 2B Requirement 21 (Offshore decommissioning).
CoT114	All permanent infrastructure located between MLWS and MHWS will be buried to a target depth of 3 metres, subject to further pre-construction surveys to be reported within Detailed CBRAs. An Outline CBRA (document reference J14) has been prepared and submitted with the application for development consent.	DCO Schedule 14 (Marine Licence 1: Morgan Offshore Wind Project Transmission Assets) Part 2 – Condition 18(1)(e)(i)(bb) (Pre-construction plans and documentation) and DCO Schedule 15 (Marine Licence 2: Morecambe Offshore Wind Farm Transmission Assets), Part 2 - Condition 18(1)(e)(i)(bb) (Pre-construction plans and documentation).
CoT116	Any material arising from sandwave clearance within the Transmission Assets Order Limits will be deposited in close proximity to the works and within the licensed disposal sites within the Order Limits, as detailed in the Dredging and Disposal - Site Characterisation Plan prepared and submitted as part of the application for development consent.	DCO Schedule 14 (Marine Licence 1: Morgan Offshore Wind Project Transmission Assets) Part 1 - Condition 2(f) (Design Parameters) and Part 2 – Condition 16(4) (Chemicals, drilling and debris); and DCO Schedule 15 (Marine Licence 2: Morecambe Offshore Wind Farm Transmission Assets) Part 1 - Condition 2(f) (Design Parameters) and Part 2 – Condition 16(4) (Chemicals, drilling and debris).

Commitment number	Measure adopted	How the measure will be secured
CoT117	The Outline Offshore CSIP includes details for any jack-up vessels used within the Fylde MCZ to be stationary. No walking jack-ups would be used within the Fylde MCZ. Detailed CSIP(s) will be developed in accordance with the Outline CSIP.	DCO Schedule 14 (Marine Licence 1: Morgan Offshore Wind Project Transmission Assets) Part 2 - Condition 18(1)(e) (Pre-construction plans and documentation) and DCO Schedule 15 (Marine Licence 2: Morecambe Offshore Wind Farm Transmission Assets), Part 2 - Condition 18(1)(e) (Pre-construction plans and documentation).

2.9 Key parameters for assessment

2.9.1 Maximum design scenario

2.9.1.1 The maximum design scenarios (MDS) identified in **Table 2.12** have been selected as those having the potential to result in the greatest effect on benthic subtidal and intertidal ecology. These scenarios have been selected from the project design envelope provided in Volume 1, Chapter 3: Project description of the ES. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the project design envelope (e.g., different infrastructure layout), to that assessed here be taken forward in the final design.

2.9.1.2 The MDSs in **Table 2.12** and assessed within section **2.11** consider the relevant construction scenario (i.e. sequential or concurrent) that equate to the MDS for that impact pathway. For example, for temporary habitat loss/disturbance the MDS is for the sequential construction scenario (i.e. construction will take place over a maximum of 30 months, noting that there is potential for a gap between the construction periods for Morgan (18 months) and Morecambe (6 months) as this equates to the greatest time over which impacts to benthic receptors may occur. It should, however, be noted that the total magnitude of each impact is the same for both the concurrent and sequential scenarios. For impacts such as increases in SSC and sediment deposition, the MDS is for activities to be carried out concurrently.

Table 2.12: Maximum design scenario considered for the assessment of impacts

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
Temporary habitat loss/ disturbance	✓	✓	✓	**Construction phase** **Subtidal** Up to 14,805,472 m^2 of subtidal habitat loss/disturbance. • Export cable installation: up to 11,331,680 m^2 of temporary habitat disturbance from installation of up to 484 km of buried offshore export cables (assumes 100% of all cables are buried) comprising: – sandwave clearance: required for up to 10% of Morgan export cables and 10% of Morecambe export cables; – pre-lay preparation (boulder and debris clearance): is likely to be required across all export cables. Although, for the purposes of the MDS, boulder clearance only has been assumed across up to 91% of Morgan export cables and 91% of Morecambe export cables (see justification); – seabed disturbance width of up to 60 m for sandwave clearance along Morgan export cables and up to 48 m for Morecambe export cables; – seabed disturbance width of up to 20 m for boulder clearance along Morgan and Morecambe export cables; and – seabed disturbance width of up 3 m for cable burial. • Sandwave clearance material deposition: up to 2,853,600 m^2 of temporary habitat loss/disturbance associated with the deposition of: – up to 1,080,000 m^3 of sandwave clearance material associated with the Morgan export cables affecting up to 2,160,000 m^2; and – up to 346,800 m^3 of sandwave clearance material associated with the Morecambe export cables affecting up to 693,600 m^2. • Anchor placements: up to 60,000 m^2 of habitat disturbance from a 100 m^2 anchor set placement (five anchors per set) event every 500 m during offshore export cable installation within the nearshore area	Maximum footprint which would be affected during the construction, operation and maintenance, and decommissioning phases. **Construction phase** Site preparation: The MDS assumes that the width of disturbance for sandwave and pre-lay preparation (boulder and debris clearance) also includes subsequent burial. Pre-lay preparation (boulder and debris clearance) is likely to be required across all export cables. For the purposes of the MDS, and to avoid double counting of the total footprint with sandwave clearance activities, the MDS assumes up to 91% of Morgan export cables will be subject to pre-lay preparation (boulder and debris clearance) only and up to 91% of Morecambe export cables will be subject to pre-lay preparation (boulder and debris clearance) only. It is anticipated that the sandwaves requiring clearance are likely to be in the range of 5 m in height. The area of seabed affected by the placement of sandwave clearance material has been calculated based on the maximum volume of sediment to be placed on the seabed, assuming all this sediment is coarse material (i.e., is not dispersed through tidal

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				(10 km for each of the four Morgan export cables and each of the two Morecambe export cables). • Cable removal: up to 560,000 m^2 from the removal of 28 km of disused cables (disturbance width of up to 20 m). • UXO removal: clearance of up to 25 UXOs (21 for Morgan OWL and 4 for Morecambe OWL) ranging from 25 kg up to 907 kg, with 130 kg being the most likely maximum. • Jack-up events to support offshore export cable pull: up to 192 m^2 of temporary habitat disturbance associated with two jack-up events for each of the four Morgan export cables and each of the two Morecambe export cables. Four legs per vessel, each with a 4 m^2 spud can affect up to 16 m^2 per jack-up. • Site preparation and construction (sequential scenario) will take place over a maximum of 30 months, noting that there is potential for a gap between the construction periods for Morgan (21 months) and Morecambe (9 months). **Intertidal** Up to 451,632 m^2 of temporary intertidal habitat loss/disturbance. • Intertidal export cable installation: offshore export cable installation at the landfall including: – open cut trenching: up to 90,000 m^2 of temporary habitat loss/disturbance, based on a total of six export cables in six trenches, a trench length of up to 300 m and working areas (including trench) of up to 50 m width; – marinised trenching: up to 360,000 m^2 of temporary habitat loss/disturbance, based on a total of six export cables in six trenches, a trench length of up to 1,200 m and working areas (including trench) of up to 50 m width; – intermediate pulling platforms: up to 1,400 m^2 of temporary habitat loss/disturbance, from up to two platforms for each of the six export cables each affecting an area of 120 m^2;	currents; see “Increased suspended sediment concentrations” impact assessment below). The total footprint of seabed affected has been calculated, for the purposes of the MDS, assuming a mound of uniform thickness of 0.5 m height. Temporary loss of benthic habitat is assumed beneath this. The disturbance width is driven by the need to survey for UXO over the cable route. The actual disturbance width for cable installation is likely to be considerably less. The sequential construction scenario is included as the maximum design scenario as this results in the longest duration of impact. **Operation and maintenance phase:** The MDS for habitat disturbance associated with export cable maintenance includes repairs/reburial of both subtidal and intertidal cables. **Decommissioning phase*:*** The MDS assumes the complete removal of all cables but that all cable protection may be left *in situ.*

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				– jack-up events to support offshore export cable pull: up to 192 m^2 of temporary habitat disturbance associated with two jack-up events for each of the four Morgan export cables and each of the two Morecambe export cables. Four legs per vessel, each with a 4 m^2 spud can affecting up to 16 m^2 per jack-up; and – cable barge grounding, cable floats and roller boxes (and associated piles) within the 50 m working corridor. **Fylde MCZ** Up to 2,497,196 m^2 of temporary habitat loss/disturbance within the Fylde MCZ. • Export cable installation for up to 64 km of Morgan offshore export cables (i.e. up to four cables each up to 16 km in length): up to 1,408,000 m^2 of temporary habitat disturbance comprising: – up to 192,000 m^2 from sandwave clearance for 5% of Morgan offshore export cables and 60 m width of disturbance; and – up to 1,216,000 m^2 from boulder clearance for 95% of Morgan offshore export cables and 20 m width of disturbance. • Export cable installation for up to 24 km of Morecambe offshore export cables (i.e. up to two cables each up to 12 km in length): up to 513,600 m^2 of temporary habitat disturbance comprising: – 57,600 m^2 from sandwave clearance for 5% of Morecambe offshore export cables and 48 m width of disturbance; and – 456,000 m^2 from boulder clearance for 95% of Morecambe offshore export cables and 20 m width of disturbance. • Sandwave clearance material deposition: up to 540,000 m^2 of habitat loss/disturbance associated with the deposition of: – up to 172,800 m^3 of sandwave clearance material associated with the Morgan export cables affecting up to 345,600 m^2; and – up to 97,200 m^3 of sandwave clearance material associated with the Morecambe export cables affecting up to 194,400 m^2.	

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				• Anchor placements: up to 35,500 m^2 of temporary habitat disturbance from a 100 m^2 anchor set placement (five anchors per set) event every 500 m for the 10 km of cable closest to the landfall, 5.80 km of which fall within the Fylde MCZ: – up to 23,500 m^2 associated with anchor placement for up to 23.20 km of Morgan offshore export cables (i.e. up to four cables each up to 5.80 km in length); and – up to 12,000 m^2 associated with anchor placement for up to 11.60 km of Morecambe offshore export cables (i.e. up to two cables each up to 5.80 km in length). • UXO removal: clearance of up to 25 UXOs (21 for Morgan OWL and 4 for Morecambe OWL) ranging from 25 kg up to 907 kg, with 130 kg being the most likely maximum. • Jack-up events to support offshore export cable pull: up to 96 m^2 of temporary habitat disturbance associated with: – Morgan export cables: four jack-up events (one for each of the four Morgan export cables); – Morecambe export cables: up to two jack-up events (one for each of the two Morecambe export cables); and – four legs per vessel, each with a 4 m^2 spud can affecting up to 16 m^2 per jack-up. • Construction (sequential scenario) will take place over a maximum of 30 months, noting that there is potential for a gap between the construction periods for Morgan (18 months) and Morecambe (6 months). **Operation and maintenance phase** **Subtidal** Up to 4,397,680 m^2 of temporary subtidal habitat disturbance due to repair/reburial of export cables:	

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				• Cable repair events: up to 1,680,00 m^2 of temporary habitat disturbance comprising: – up to 1,120,000 m^2 for repair of Morgan subtidal export cables: up to 14 repair events (one repair event for each of the four export cables every 10 years) affecting up to 4 km per repair event with a 20 m width of disturbance; and – up to 560,000 m^2 for repair of Morecambe subtidal export cables: up to seven repair events (one repair for each of the two export cables every 10 years) affecting up to 4 km per repair event with a 20 m width of disturbance. • Cable reburial events: up to 2,716,000 m^2 of temporary habitat disturbance comprising: – up to 2,240,000 m^2 for the reburial of Morgan subtidal export cables: one reburial event every five years (seven reburial events in total) affecting up to 16 km of export cables per event with a 20 m width of disturbance; and – up to 476,000 m^2 for the reburial of Morecambe subtidal export cables: one reburial event every five years (seven reburial events in total) affecting up to 3.4 km of export cables per event with a 20 m width of disturbance. • Jack-up events: up to 1,680 m^2 from up to two jack-up events per year for the Morgan export cables, and up to one jack-up event per year for the Morecambe export cables. Four legs per vessel, each with a 4 m^2 spud can affecting up to 16 m^2 per jack-up. **Intertidal** Up to 553,680 m^2 of temporary intertidal habitat disturbance comprising: • Cable repair events: up to 272,000 m^2 of temporary intertidal habitat disturbance comprising: – up to 80,000 m^2 for repair of Morgan intertidal export cables: up to four repair events (one repair event every ten years) affecting up to	

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				1 km of intertidal cables per event with a 20 m width of disturbance; and – up to 192,000 m² for repair of Morecambe intertidal export cables: up to four repair events (one repair event every 10 years) affecting up to 2.4 km of intertidal cables per repair event with a 20 m width of disturbance. • Cable reburial events: up to 280,000 m² of temporary intertidal habitat disturbance comprising: – up to 140,000 m² for reburial of Morgan intertidal export cables: up to seven reburial events (one every five years) affecting up to 1 km of intertidal cables per event with a 20 m width of disturbance; and – up to 140,000 m² for reburial of Morecambe intertidal export cables: up to 14 reburial events (two every five years) affecting up to 500 m per reburial event with a 20 m width of disturbance. • Jack-up events: up to 1,680 m² from up to two jack-up events per year for the Morgan export cables, and up to one jack-up event per year for the Morecambe export cables. Four legs per vessel, each with a 4 m² spud can affecting up to 16 m² per jack-up. • Operational phase up to 35 years. **Fylde MCZ** Up to 834,024 m² of temporary habitat loss/disturbance within the Fylde MCZ comprising: • Cable repair events: up to 339,360 m² of temporary habitat disturbance comprising: – 179,200 m² for Morgan offshore export cables: up to 14 repair events (one repair event for each of the four export cables every 10 years) affecting up to 0.64 km of cable per repair event (i.e. 16% of the total 4 km of cable that could be affected per repair event for the whole project) with a 20 m width of disturbance. – 160,160 m² for Morecambe offshore export cables: up to seven repair events (one repair for each of the two offshore export cables every 10	

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				– years) affecting up to 1.144 km per repair event (i.e. 28.6% of the total 4 km of cable that could be affected per repair event for the whole project) with a 20 m width of disturbance. • Cable repair events: up to 494,536 m^2 of temporary habitat disturbance comprising: – 358,400 m^2 for Morgan offshore export cables: up to seven reburial events (one reburial event every five years) affecting up to 2.56 km per reburial event (i.e. 16% of the total 16 km that could be affected per reburial event for the whole project) with a 20 m width of disturbance. – 136,136 m^2 for Morecambe offshore export cables: up to seven reburial events (one reburial event every five years) affecting up to 0.972 km per reburial event (i.e. 28.6% of the total 3.4 km of cable that could be affected per reburial event for the whole project) with a 20 m width of disturbance. • Jack-up events to support intertidal cable repair: up to 128 m^2 of temporary habitat disturbance associated with: – Morgan export cables: up to four jack-up events; – Morecambe export cables: up to four jack-up events; and – four legs per vessel, each with a 4 m^2 spud can affecting up to 16 m^2 per jack-up. • Operational phase up to 35 years. **Decommissioning phase** Temporary subtidal habitat loss/disturbance due to: • Subtidal cable removal: disturbance from the removal of up to 484 km of Morgan and Morecambe export cables. **Fylde MCZ**	

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				Up to 1.76 km^2 from the removal of subtidal export cables within the Fylde MCZ.	
Increased SSC and associated deposition	✓	✓	✓	**Construction phase** **Site preparation**. Sandwave clearance of up to 1,426,800 m^3 undertaken over an approximate 12 month duration: • Morgan export cable: sandwave clearance along 10% of 400 km of export cable length with a width of 60 m. This equates to a total spoil volume of 1,080,000 m^3 associated with the cable corridor. • Morecambe export cable: sandwave clearance along 10% of 84 km of export cable length, with a width of 48 m. This equates to a total spoil volume of 346,800 m^3. • Removal of up to 28 km of disused cables. **Fylde MCZ** • MCZ: sandwave clearance along 5% of the 64 km of Morgan offshore export cables within Fylde MCZ and 5% of the 24 km of Morecambe offshore export cable within Fylde MCZ. This equates to a total spoil volume of 172,800 m^3 for the Morgan offshore export cables within the Fylde and a total spoil volume of 97,200 m^3 for the Morecambe offshore export cables within the Fylde MCZ. Sandwave clearance within the MCZ represents 3% of the total offshore export cable. **Cable installation**. Total spoil volume of up to 2,178,000 m^3 for cable installation • Offshore export cables: Installation via trenching of up to 484 km of cable, with a trench width of up to 3 m and a depth of up to 3 m. Total spoil volume of 2,178,000 m^3. Installed over approximately 21 month concurrent construction period (Morgan offshore export cables: three months site preparation + 18 months construction, Morecambe offshore	**Construction phase** **Site preparation.** • The volume of material to be cleared from individual sandwaves will vary according to the local dimensions of the sandwave (height, length, and shape) and the level to which the sandwave must be reduced. As shown in Figure 1.4 (Volume 2, Figures), sandwaves are most prevalent within the Morgan Offshore Wind Project: Generation Assets where sandwave heights can be as great as 5 m at the bedforms crest. Given updated analysis of bedforms and morphology within the Offshore Order Limits, sandwave clearance values used within the ES have been significantly reduced from those used in PEIR. • Site clearance activities may be undertaken using a range of techniques, the suction hopper dredger will result in the greatest increase in suspended sediment and largest plume extent as material is released near the water surface during the disposal of material. • Boulder clearance activities will result in minimal increases in SSCs and have

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				export cables: three months site preparation + six months construction). **Fylde MCZ** • MCZ: Installation via trenching of up to 88 km of cable, with a trench width of up to 3 m and a depth of up to 3 m. Total spoil volume of 396 m^3. Installed over approximately 21 month concurrent construction period (Morgan offshore export cables: three months site preparation + 18 months construction, Morecambe offshore export cables: three months site preparation + six months construction). **Operation and maintenance phase** • Operational life of 35 years. • The MDS for cable repair and reburial events is as described above for temporary habitat loss and disturbance during the operation and maintenance phase. **Fylde MCZ** • The MDS for cable repair and reburial events is as described above for temporary habitat loss and disturbance in the Fylde MCZ during the operation and maintenance phase. **Decommissioning phase** • All export cables will be removed and disposed of onshore, including from the Fylde MCZ. • Cable protection will remain *in situ* (however all external cable protection used within the MCZ will be designed to be removable on decommissioning (CoT108) with the requirement for removal agreed with stakeholders and regulators in lines with best practice and guidance at the time of decommissioning (CoT109)).	therefore not been considered in the assessment. • The scenario assessed relates to the largest potential volume of material related to site preparation activities. **Cable Installation.** • Cable routes inevitably include a variety of seabed material and in some areas 3 m depth may not be achieved or may be of a coarser nature which settles in the vicinity of the cable route. The assessment therefore considers the upper bound in terms of suspended sediment and dispersion potential assuming a trench with "v" shape cross section. • Cables may be buried by ploughing, trenching or jetting with jetting mobilising the greatest volume of material to increase SSCs. • Open-cut trenching represents the MDS for cable installation within the intertidal area. The offshore export cables transitioning onshore will be installed using the direct pipe trenchless technique under the Dunes. The direct pipe installation is a fully cased system which reduces risks associated with frack out of drilling fluids. It is anticipated that the direct pipe will exit on the beach around MHWS with a minimum offset distance of 15 m from boundary of the Lytham

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
					St Annes Dunes SSSI (see CoT44), however, this may require the installation of cofferdams. The offshore export cables will be buried between the direct pipe exit pits and MLWS via open trenching. The trench is likely to be a stepped side trench to maintain stability with a top width of up to 10 m and a depth of approximately 3 m. Up to 300 m of open trenching may be required per cable. • The concurrent construction scenario is included as the maximum design scenario as this has the potential to result in the greatest increase in suspended sediments. **Operation and maintenance phase** • The greatest foreseeable number of cable reburial and repair events is considered to be the MDS for sediment dispersion. **Decommissioning phase** • The removal of cables may be undertaken using similar techniques to those employed during installation, therefore the potential increases in SSC and deposition would be in-line with the construction phase. Although specific techniques relating to the removal of cables may be development during the project lifetime, the MDS

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
					assumes as a worst case that techniques similar to construction will be employed during the decommissioning phase. • It should be noted that the MDS has assessed that cable protection will remain *in situ* during the decommissioning phase, however there is a commitment (CoT108), as outlined in **Table 2.11**, to remove cable protection within the MCZ in accordance with the Offshore Decommissioning Programme. In this respect the approach used within the assessment is a conservative one.
Disturbance/remobilisation of sediment-bound contaminants	✓	✓	✓	**Construction phase** • The MDS as described above for increased SSC and associated deposition during the construction phase. **Operation and maintenance phase** • The MDS as described above for increased SSC and associated deposition during the operation and maintenance phase. **Decommissioning phase** • The MDS as described above for increased SSC and associated deposition during the decommissioning phase.	The MDS as per increased SSC and associated deposition impact assessment above.
Long term habitat loss	✓	✓	✓	**Construction and operation and maintenance phases** Up to 576,500 m^2 of long term subtidal habitat loss over the lifetime of the Transmission Assets. • Presence of cable protection: up to 484,000 m^2 of habitat loss comprising:	The maximum length of cables and cable protection resulting in greatest extent of habitat loss. Construction scenarios have no influence on the maximum design scenario of this impact as effects will primarily occur

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				– Morgan offshore export cable protection: 400,000 m^2 from cable protection associated with up to 10% of the 400 km of Morecambe export cables (with a width of 10 m); and – Morecambe offshore export cable protection: 84,000 m^2 from cable protection associated with up to 10% of the 84 km of Morecambe export cables (with a width of 10 m). • Presence of cable crossing protection: up to 92,500 m^2 of habitat loss comprising: – Morgan cable protection for cable crossings for offshore export cables (outwith the Fylde MCZ): 61,500 m^2 from 41 crossings (each up to 50 m in length and 30 m in width); and – Morgan cable protection for cable crossings for offshore export cables (within the Fylde MCZ): 4,000 m^2 from four crossings (one for each of the four Morgan export cables), each up to 50 m in length and 20 m in width); and – Morecambe cable protection for cable crossings for offshore export cables (outwith the Fylde MCZ): 27,000 m^2 from six crossings (each up to 150 m in length and 30 m in width). • Operational phase up to 35 years. **Fylde MCZ** Up to 30,400 m^2 of long term habitat loss within the Fylde MCZ over the lifetime of the Transmission Assets. • Presence of cable protection: up to 26,400 m^2 of habitat loss comprising: – Morgan offshore export cable protection: 19,200 m^2 from cable protection associated with up to 3% of the 64 km of Morgan export cables within the MCZ (with a width of 10 m); and – Morecambe offshore export cable protection: 7,200 m^2 from cable protection associated with up to 3% of the 24 km of Morecambe export cables within the MCZ (with a width of 10 m). • Presence of cable crossing protection: up to 4,000 m^2 of habitat loss comprising:	during the operation and maintenance phase. The MDS for decommissioning (and permanent habitat loss following decommissioning) assumes that cables and cable protection will remain *in situ*. Therefore the maximum amount of cable protection resulting in the largest area of infrastructure to be left *in situ* after decommissioning.

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				– Morgan cable protection for cable crossings for offshore export cables: 4,000 m² from four crossings (one crossing for each of the four Morgan export cables), each up to 50 m in length and 20 m in width. – No cable crossings required for the Morecambe offshore export cables. **Decommissioning phase** Up to 576,500 m² of permanent subtidal habitat loss due to cable protection left *in situ* post decommissioning. **Fylde MCZ** All external cable protection used within the MCZ will be designed to be removable on decommissioning with the requirement for removal agreed with stakeholders and regulators in lines with best practice and guidance at the time of decommissioning.	
Introduction of artificial structures	✓	✓	✓	**Construction and operation and maintenance phases** Introduction of up to 576,500 m² of artificial structures over the lifetime of the Transmission Assets comprising: • Cable protection: Up to 484,000 m² from presence of cable protection associated with up to 484 km of offshore export cables: – assumes up to 10% of Morgan export cables may require protection resulting in creation of 400,000 m²; and – assumes up to 10% of Morecambe export cables may require protection resulting in creation of 84,000 m². • Cable crossing protection: Up to 92,500 m² from presence of cable protection for cable crossings: – Morgan cable protection for cable crossings for offshore export cables (outwith the Fylde MCZ): 61,500 m² from 41 crossings (each up to 50 m in length and 30 m in width); – Morgan cable protection for cable crossings for offshore export cables (within the Fylde MCZ): 4,000 m² from four crossings (one crossing	The maximum length of cables and cable protection resulting in greatest surface area for colonisation.

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				for each of the four Morgan export cables, each up to 50 m in length and 20 m in width); and – Morecambe cable protection for cable crossings for offshore export cables: 27,000 m² from six crossings (each up to 150 m in length and 30 m in width). – up to 41 crossings for each of the Morgan export cables outwith the Fylde MCZ (each up to 50 m in length and 30 m in width); – up to four crossings (one for each of the Morgan export cables) within the Fylde MCZ (each up to 50 m in length and 20 m in width; and – up to six crossings for each of the Morecambe export cables outwith the Fylde MCZ (each up to 150 m in length and 30 m in width). • Operational phase up to 35 years. **Fylde MCZ** The MDS is as described above for long term habitat loss in the Fylde MCZ during the construction and operation and maintenance phases. **Decommissioning phase** • Up to 576,500 m² of artificial structures remaining post-decommissioning due to scour and cable protection being left *in situ*.	
Increased risk of introduction and spread of INNS	✓	✓	✓	**Construction phase** Increased risk of INNS due to: – long term habitat creation: up to 576,500 m² as set out in the introduction of artificial structures impact above; and – vessel movement: vessels associated with site preparation, export cables, and landfall works, with up to 286 vessel round trips in total over at least a 30 month (sequential) construction phase (a smaller number will overlap with the Fylde MCZ).	Maximum surface area created by offshore infrastructure and maximum number of vessel movements during construction, operation and maintenance and decommissioning phases.

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				• Construction (sequential scenario) will take place over a maximum of 30 months, noting that there is potential for a gap between the construction periods for Morgan (18 months) and Morecambe (6 months). **Operation and maintenance phase** Increased risk of INNS due to: – vessel return trips: Up to 77 vessel return trips per year during the operation and maintenance phase (a smaller number will overlap with the Fylde MCZ); and • Operational phase up to 35 years. **Decommissioning phase** Increased risk of INNS due to: – long-term habitat creation: up to 576,500 m^2 due to cable protection left *in situ* post decommissioning; and – vessel return trips: Up to 286 decommissioning vessel return trips during the decommissioning phase (a smaller number will overlap with the Fylde MCZ). • Maximum duration of the decommissioning phase is at least 30 months (sequential construction scenario).	
Removal of hard substrates	×	×	✓	**Decommissioning phase** Removal of hard substrate of up to 576,000 m^2 (including all within Fylde MCZ) due to: – removal of 465,500 m^2 of cable protection and cable crossings from the Morgan export cables; and – removal of 111,000 m^2 of cable protection and cable crossings from the Morecambe export cables. • Maximum duration of the decommissioning phase is at least 30 months (sequential construction scenario).	The MDS is based on the potential for the removal of all cable protection and cable crossings.

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
Changes in physical processes	×	✓	✓	**Operation and maintenance phase** • Morgan export cables: cable protection along 10%/40 km of the cable, with a height of up to 2 m and up to 10 m width. Up to 45 cable crossings, each crossing has a height of up to 2.8 m (2 m in the Fylde MCZ), a width of up to 30 m (20 m in the Fylde MCZ) and a length of up to 150 m. • Morecambe export cables: cable protection along 10%/8.4 km of the cable, with a height of up to 2 m and up to 10 m width. Up to six cable crossings, each crossing has a height of up to 2.8 m, a width of up to 30 m and a length of up to 150 m. **Fylde MCZ** • The MDS is as described above for long term habitat loss in the Fylde MCZ during the construction and operation and maintenance phases. **Decommissioning phase** • Cable protection will remain *in situ* and continue to influence tidal regime.	This provides the largest obstruction to flow in the water column. See Volume 2, Chapter 1: Physical processes of the ES.
Impacts to benthic invertebrates due to EMF	×	✓	×	**Operation and maintenance phase** Presence of offshore export cables. • Export cables: up to 484 km of 220 kV or 275 kV High Voltage Alternation Current (HVAC) cables. • Minimum burial depth 0.5 m. • Up to 10% of Morgan export cables and 10% of Morecambe export cables may require additional cable protection. • Cable protection: cables will also require cable protection at asset crossings (up to 45 crossings for the Morgan export cables and up to six cable crossings for the Morecambe export cables). • Operation and maintenance phase of up to 35 years. **Fylde MCZ**	Maximum length of cables across the Transmission Assets and offshore export cable route and minimum burial depth (the greater the burial depth, the more the EMF is attenuated).

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				Up to 88 km of active cables within the Fylde MCZ during the operation and maintenance phase.	
Heat from subsea electrical cables	×	✓	×	**Operation and maintenance phase** Presence of offshore export cables. • Export cables: up to 484 km of 220 kV or 275 kV HVAC cables. • Minimum burial depth 0.5 m. • Up to 10% of Morgan export cables and 10% of Morecambe export cables may require additional cable protection. • Cable protection: cables will also require cable protection at asset crossings (up to 45 crossings for the Morgan export cable and six cable crossings for the Morecambe export cable). • Operation and maintenance phase of up to 35 years. **Fylde MCZ** Up to 88 km of active cables within the Fylde MCZ during the operation and maintenance phase.	Maximum length of cables across the Transmission Assets and offshore export cable route and minimum burial depth.

[a] C=construction, O=operation and maintenance, D=decommissioning

2.10 Assessment methodology

2.10.1 Overview

2.10.1.1 The approach to determining the significance of effects is a two-stage process that involves defining the magnitude of the impact and the sensitivity of the receptor. This section describes the criteria applied in this chapter to assign values to the magnitude of impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in Volume 1, Chapter 5: Environmental assessment methodology of the ES.

2.10.2 Receptor sensitivity/value

2.10.2.1 The MarESA has been drawn upon to support the assessment of sensitivity of the benthic subtidal and intertidal ecology IEFs within the Transmission Assets.

2.10.2.2 The MarESA is a database which has been developed through the Marine Life Information Network of Britain and Ireland and is maintained by the Marine Biological Association, supported by statutory organisations in the UK (e.g. Department of Agriculture, Environment and Rural Affairs, JNCC, Natural England and NatureScot). This database comprises a detailed review of available evidence on the effects of pressures on marine species or habitats, and a subsequent scoring of sensitivity against a standard list of pressures, and their benchmark levels of effect. The evidence base presented in the MarESA is peer reviewed and represents the largest review undertaken to date on the effects of human activities and natural events on marine species and habitats. It is considered to be one of the best available sources of evidence relating to recovery of seabed species and habitats. The benchmarks for the relevant MarESA pressures which have been used to inform each impact assessment have also been referenced under each impact assessment in **section 2.11**.

2.10.2.3 The sensitivities of benthic subtidal and intertidal IEFs presented within this chapter have therefore been defined by an assessment of the combined vulnerability (i.e. resistance, following MarESA) of the receptor to a given impact and the likely rate of recoverability to pre-impact conditions (i.e. resilience). Here, vulnerability is defined as the susceptibility of a species to disturbance, damage or death, from a specific external factor. Recoverability/resilience is the ability of the same species to return to a state close to that which existed before the activity or event which caused change. Recoverability is dependent on a receptor’s ability to recover or recruit subject to the extent of disturbance/damage incurred. Information on these aspects of sensitivity of the benthic subtidal and intertidal IEFs to given impacts has been informed by the best available evidence following environmental impact or experimental manipulation in the field and evidence from the offshore wind industry and transmission infrastructure and analogous activities such as those associated with aggregate extraction, electrical cabling, and oil and gas industries.

2.10.2.4 Definitions for terms relating to receptor sensitivity (applicable to MarESA) are outlined in **Table 2.13** below.

Table 2.13: Definition of terms relating to the sensitivity of the receptor

Recoverability/ Resilience	Resistance			
	None	**Low**	**Medium**	**High**
Very low	High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Low	High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Medium	Medium sensitivity	Medium sensitivity	Medium sensitivity	Low sensitivity
High	Medium sensitivity	Low sensitivity	Low sensitivity	Not sensitive (negligible)

2.10.2.5 The conclusions of the MarESA have been combined with the importance of the relevant IEFs as presented in **Table 2.8**. The criteria for defining sensitivity in this chapter are outlined in **Table 2.14** below, with a precautionary approach applied when considering the value of receptors. When a receptor is known to have no sensitivity to a defined impact, the sensitivity has been assigned as negligible.

Table 2.14: Sensitivity criteria

Sensitivity	Definition
Very High	Nationally and internationally important receptors with high vulnerability and no ability to recover.
High	Regionally important receptors with high vulnerability and no ability to recover. Nationally and internationally important receptors with high vulnerability and low recoverability.
Medium	Nationally and internationally important receptors with medium to very high vulnerability and medium to high recoverability. Regionally important receptors with medium to high vulnerability and low recoverability. Locally important receptors with high vulnerability and no ability to recover.
Low	Nationally and internationally important receptors with low to medium vulnerability and high recoverability. Regionally important receptors with low vulnerability and medium to high recoverability. Locally important receptors with medium to high vulnerability and low recoverability.
Negligible	Locally important receptors with low vulnerability and medium to high recoverability. Receptor is not vulnerable or sensitive to impacts regardless of value/importance.

2.10.3 Magnitude of impact

2.10.3.1 The criteria for defining magnitude in this chapter are outlined in **Table 2.15** below.

Table 2.15: Magnitude of impact criteria

Magnitude of impact		Definition
High	Adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.
	Beneficial	Large scale or major improvement or resource quality; extensive restoration or enhancement; major improvement of attribute quality.
Medium	Adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Low	Adverse	Some measurable change in attributes, quality or vulnerability, minor loss or, or alteration to, one (maybe more) key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
	Beneficial	Very minor benefit to, or positive addition of one or more characteristics, features or element.

Magnitude of impact	Definition
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

2.10.3.2 The following definitions for short, medium, and long term effects have been applied throughout:

- short term: a period of months, up to one year;
- medium term: a period of more than one year, up to five years; or
- long term: a period of greater than five years.

2.10.3.3 Temporary impacts have been assumed, for the purposes of this assessment, to be those associated with potential changes during the construction and decommissioning phases of the Transmission Assets, which are either reversible and/or benthic receptors have the ability to recover from in the short to medium term.

2.10.4 Significance of effect

2.10.4.1 The significance of the effect upon benthic subtidal and intertidal ecology has been determined by taking into account the sensitivity of the receptor and the magnitude of the impact. The method employed for this assessment is presented in **Table 2.16**. Where a range of significance levels is presented, the final assessment for each effect is based upon expert judgement.

2.10.4.2 In all cases, the evaluation of receptor sensitivity, impact magnitude and significance of effect has been informed by professional judgement and is underpinned by narrative to explain the conclusions reached.

2.10.4.3 For the purpose of this assessment, any effects with a significance level of minor or less are not considered to be significant in terms of the EIA Regulations.

Table 2.16: Assessment matrix

Sensitivity of Receptor	Magnitude of Impact			
	Negligible	**Low**	**Medium**	**High**
Negligible	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	Negligible or Minor	Minor	Moderate	Moderate or Major
High	Minor	Minor or Moderate	Moderate or Major	Major
Very High	Minor	Moderate or Major	Major	Major

2.10.4.4 The definitions for significance of effect levels are described as follows.

- Major: These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category. Effects upon human receptors may also be attributed this level of significance.
- Moderate: These beneficial or adverse effects have the potential to be important and may influence the key decision-making process. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse or beneficial effect on a particular resource or receptor.
- Minor: These beneficial or adverse effects are generally, but not exclusively, raised as local factors. They are unlikely to be critical in the decision-making process but are important in enhancing the subsequent design of the project.
- Negligible: No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

2.10.5 Assumptions and limitations of the assessment

2.10.5.1 The survey DDV component experienced few significant technical or mechanical issues, with seabed imagery transects being interrupted due to strong currents or poor visibility at only eight stations, with usable data subsequently collected on second attempt transects. The survey grab sampling similarly experienced few issues, with a small number of trigger or closing failures, but these did not impede overall collection of data and the physical limitations were minor.

2.10.5.2 Although the sampling design and collection process for the site-specific benthic subtidal ecology survey data provided robust data on the benthic communities, interpreting these data has limitations. It can be difficult to interpolate data collected from discrete sample locations to cover a wider area and define the precise extents of each biotope. Benthic communities generally show a gradual transition from one biotope to another and therefore boundaries of where one biotope ends and the next begins is an approximation; these boundaries indicate where communities grade into one another. The classification of the community data into biotopes is a best fit allocation, as some communities do not readily fit the available descriptions in the biotope classification system. The biotope map should be used to describe the main habitats which characterised the Transmission Assets. Due to the limitations described previously, the biotope map shown in Figure 2.3 (Volume 2, Figures) should not be interpreted as definitive areas. However, this does provide a suitable baseline characterisation which describes the main habitats and communities within the Transmission Assets for the purposes of the assessment.

2.11 Assessment of effects

2.11.1 Introduction

2.11.1.1 The impacts arising from the construction, operation and maintenance, and decommissioning phases of the Transmission Assets are listed in **Table 2.12** along with the MDS against which each impact has been assessed. The potential impacts are also listed in **Table 2.17** together with the IEFs which have been assessed for each potential impact pathway.

2.11.1.2 A description of the likely effect on receptors caused by each identified impact is given below.

Table 2.17: Summary of IEFs assessed for each potential impact pathway for the Transmission Assets alone assessment

IEF	Temporary habitat loss/disturbance	Increased suspended sediment concentration and associated deposition	Disturbance/remobilisation of sediment-bound contaminants	Long term habitat loss	Introduction of artificial structures	Increased risk of introduction and spread of invasive non-native species	Removal of hard substrate	Changes in physical processes	Impact to benthic invertebrates due to EMF	Heat from subsea electrical cables
Subtidal habitats										
Subtidal coarse and mixed sediments with diverse benthic communities.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Brittlestar beds	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Subtidal muddy sands with relatively species poor benthic communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Annex I low resemblance stony reef (outside an SAC)	×	✓	✓	×	×	×	×	✓	×	×
Seapens and burrowing megafauna communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

IEF	Temporary habitat loss/disturbance	Increased suspended sediment concentration and associated deposition	Disturbance/remobilisation of sediment-bound contaminants	Long term habitat loss	Introduction of artificial structures	Increased risk of introduction and spread of invasive non-native species	Removal of hard substrate	Changes in physical processes	Impact to benthic invertebrates due to EMF	Heat from subsea electrical cables
Annex I habitat features of SACs										
Sandbanks which are slightly covered by sea water all the time	×	✓	✓	×	×	×	×	✓	×	×
Reefs	×	✓	✓	×	×	×	×	✓	×	×
Broadscale habitats: features of MCZs										
Subtidal mud	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Subtidal sand	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Subtidal coarse sediment	×	✓	✓	×	×	×	×	✓	×	×
Subtidal mixed sediment	×	✓	✓	×	×	×	×	✓	×	×
Seapens and burrowing megafauna communities	×	✓	✓	×	×	×	×	✓	×	×
Intertidal habitats										
Species poor/barren sands	✓	✓	✓	×	×	×	×	✓	×	×

IEF	Temporary habitat loss/disturbance	Increased suspended sediment concentration and associated deposition	Disturbance/remobilisation of sediment-bound contaminants	Long term habitat loss	Introduction of artificial structures	Increased risk of introduction and spread of invasive non-native species	Removal of hard substrate	Changes in physical processes	Impact to benthic invertebrates due to EMF	Heat from subsea electrical cables
Polychaete/ bivalve-dominated muddy sand shores	✓	✓	✓	×	×	×	×	✓	×	×
Echinocardium cordatum and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand	✓	✓	✓	×	×	×	×	✓	×	×

2.11.2 Temporary habitat loss/disturbance

2.11.2.1 Temporary habitat loss/disturbance of subtidal habitats within the Offshore Order Limits will occur during the construction, operation and maintenance, and decommissioning phases. Temporary habitat loss/disturbance may result from activities including offshore cable installation, sandwave clearance, anchor placement, pre-lay preparation (e.g. boulder and debris clearance), UXO clearance, cable installation and repair including trenching across the intertidal zone, and removal of existing cables associated with these activities. The MDS for temporary habitat loss/disturbance is summarised in **Table 2.12**.

2.11.2.2 The relevant MarESA pressures and associated benchmarks which have been used to inform this impact assessment are listed below.

- Habitat structure changes: removal of substratum (extraction): the benchmark for which is the extraction of substratum to 30 cm. This pressure is considered to be analogous to the impacts associated with sandwave clearance and pre-lay preparation (e.g. boulder and debris clearance), UXO clearance and the construction of exit pits associated with trenchless techniques such as HDD.
- Abrasion/disturbance at the surface of the substratum or seabed: the benchmark for which is damage to surface features (e.g. species and physical structures within the habitat). This pressure corresponds to the impacts associated with jack-up vessel operation and anchor placements.
- Penetration and/or disturbance of the substratum subsurface: the benchmark for which is damage to sub-surface features (e.g. species and physical structures within the habitat). This pressure corresponds to the impacts associated with cable installation, jack-up vessel operation, and the removal of existing cables.
- Smothering and siltation rate changes (heavy): the benchmark for which is heavy deposition of up to 30 cm of fine material added to the habitat in a single discrete event. This pressure corresponds to impacts associated with the deposition of sandwave material dredged prior to cable installation.

2.11.2.3 This assessment considers the short-medium term, temporary impacts associated with the Transmission Assets, as summarised in **paragraph 2.11.2.1**, from which it is predicted that benthic IEFs will recover from. Where temporarily disturbed sediments are subsequently covered with infrastructure (i.e. cable protection), the resulting habitat loss or change associated would be long-term or permanent and this has been assessed separately in **section 2.11.5**.

Construction phase

Sensitivity of the receptor

Subtidal habitat IEFs

2.11.2.4 The subtidal habitat IEFs which are expected to be affected by temporary subtidal habitat loss/disturbance are those which occur within the Offshore Order Limits (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, brittlestar beds IEF, subtidal muddy sands with relatively species poor benthic communities IEF, subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF and seapens and burrowing megafauna communities IEF). The sensitivity of the IEFs to temporary subtidal habitat loss are presented in **Table 2.18** and range from not sensitive to high sensitivity. These sensitivities are based on assessments made by the MarESA. Most IEFs have medium sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance.

2.11.2.5 The subtidal coarse and mixed sediments with diverse benthic communities IEF has an overall low to medium sensitivity to the pressures comprising temporary habitat loss/disturbance. The biotopes which characterise this IEF include SS.SMx.OMx.PoVen, SS.SMx.CMx.KurThyMx, SS.SCS.CCS and SS.SMx.OMx.

2.11.2.6 Specifically, for SS.SMx.OMx.PoVen, thick-shelled bivalves, hermit crabs and gastropods appeared unaffected by dredging (Colie *et al*., 1997), and burrowing species such as *Glycera lapidum* and *Lumbrineris latreilli* may be unaffected by surface abrasion. The trawling studies and the comparative study by Capasso *et al*. (2010) suggest that the biological assemblage present in this biotope is characterised by species that are relatively tolerant of penetration and disturbance of the sediments, indicating a low sensitivity to minor physical disturbance activities. Also, for heavy siltation events, Bijkerk (1988, results cited from Essink, 1999) indicated that the maximal overburden through which small bivalves could migrate was 20 cm in sand for *Donax* spp. and 50 cm for *Tellina* spp., indicating a medium sensitivity to this impact.

2.11.2.7 The SS.SMx.CMx.KurThyMx biotope has a low sensitivity to abrasion and surface penetration, with mortality of *K. bidentata* from trawling activities in sandy sediment reported as 4% (Bergman and van Santbrink, 2000), and direct mortality (percentage of initial density) of *Thyasira flexuosa* estimated as 0-28%, based on samples taken before and 24 hours after trawling (Ball *et al*., 2000). These species also have a typically low sensitivity to heavy rates of smothering and siltation, with burrowing through up to 50 cm of sediment likely (Bijkerk (1988, results cited from Essink, 1999)).

2.11.2.8 The subtidal muddy sands with relatively species poor benthic communities IEF included the biotopes SS.SMu.CMuSa, SS.SMu.CSaMu.LkorPpel, and SS.SMu.CSaMu.AfilKurAnit. These biotopes had a range of sensitivities to the MarESA pressures ranging from low to medium (**Table 2.18**). For bivalve dominated biotopes, although burrowing life habits may provide some protection from damage by abrasion at the surface, a proportion of the population is likely to be damaged or removed by abrasion or extractive activities, with escape potential present in species such as *Arctica islandica*, *M. balthica* and *Mya arenaria* when buried in up to 41 cm of sediment (Powilleit *et al*., 2009), indicating a medium sensitivity to these disturbance pressures. The SS.SMu.CSaMu.LkorPpel biotope is characterised by the opportunistic *Lagis koreni*, which has been noted as dominant at a dredged material site in Liverpool Bay (Whomerslwey *et al*., 2008) and the similarly opportunistic *P. pellucidus* which also dominates dredge spoil dump sites (Rees *et al*., 1992). This indicates a broadly low sensitivity of this biotope to disturbance pressures.

2.11.2.9 The seapens and burrowing megafauna communities IEF has a medium to high sensitivity to the defined MarESA pressures (**Table 2.18**), with no sensitivity to heavy siltation due to the burrowing species present being active burrowers (Hughes, 1998) and therefore able to escape from any heavy smothering impacts. The other physical disturbance pressure assessments are mainly centred on the responses of the seapens *P. phosphorea* and *V. mirabilis.* Given that seapens are understood to be absent from the survey area (**section 2.6.3**), and whilst acknowledging that other burrowing megafauna may still be affected, it is considered that, in this instance, a sensitivity of medium would be appropriate for this IEF (as opposed to the high sensitivity allocated to the biotope by the MarESA).

2.11.2.10 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF includes the SS.SSa.CMuSa.AalbNuc, SS.SSa.CFiSa.EpusOborApri, SS.SSa.IFiSa, SS.SSa.CFiSa and SS.SSa.CFiSa.ApriBatPo biotopes and has a low sensitivity to penetration and surface abrasion and medium sensitivity to removal of substratum and heavy smothering. This sandy sediment environment has been characterised by polychaetes such as *G. lapidum* and bivalves such as *Moerella* sp., *Spisula elliptica* and *Asbjornsenia pygmaea* which are unlikely to experience anything other than localised decline in species richness. The majority of infauna will be expected to burrow back into the sediment following displacement or are adapted to habitats with frequent disturbance (natural or anthropogenic) and recover quickly (Tillin *et al*., 2022). The removal of substratum and heavy siltation are the highest sensitivity activities related to this impact as it would result in the removal of epifauna and any shallow buried species such as *Glycymerids* (Tillin *et al*., 2016) or potentially for some species to be over burdened with sediment and unable to burrow out (Tillin and Budd, 2023).

2.11.2.11 The brittlestar beds IEF has a medium sensitivity to the pressures comprising temporary habitat loss/disturbance (**Table 2.18**). Specifically, habitat structure changes through abrasion and disturbance of the seabed would likely cause the sediment underlying this epifaunal biotope to be removed along with the biological community, resulting in the removal of the biotope in areas of heavy disturbance activity (Bradshaw *et al*., 2002). However, brittlestars can tolerate considerable damage to arms and even the disk without suffering mortality and are capable of arm and even some disk regeneration (Sköld, 1998). Evidence shows that an average of 36% of individuals in five British brittlestar beds damaged by physical abrasion were regenerating arms (Aronson, 1989) showing that the beds can persist following exposure to this pressure and recover. Dense beds of brittlestars tend not to persist in areas of excessive sedimentation, because high levels of sediment foul the brittlestars feeding apparatus (tube feet and arm spines), and ultimately suffocates them (Schäfer, 1962 cited in Aronson, 1992), but the high recovery rate gives this a medium sensitivity to this pressure overall.

2.11.2.12 The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high to low vulnerability and high to medium recoverability and, based on assessments made by the MarESA, is of overall low to medium sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance (**Table 2.18**). The subtidal coarse and mixed sediments with diverse benthic communities IEF is of national value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.14**. The sensitivity of the receptor is considered to be **medium**.

2.11.2.13 The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of low to medium vulnerability and high to medium recoverability and, based on assessments made by the MarESA, is of overall low to medium sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance. The subtidal muddy sands with relatively species poor benthic communities IEF is of national value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.14**. The sensitivity of the receptor is considered to be **medium**.

2.11.2.14 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of medium to very high vulnerability and high to medium recoverability and, based on assessments made by the MarESA, is of overall low to medium sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance (**Table 2.18**). The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is of national value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.14**. The sensitivity of the receptor is considered to be **medium**.

2.11.2.15 The seapens and burrowing megafauna communities IEF is deemed to be of low to high vulnerability and low to high recoverability and of national value. Based on assessments made by the MarESA, it is of overall high sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance (**Table 2.18**). The seapens and burrowing megafauna communities IEF is of national value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.18**. The sensitivity of the receptor is considered to be **high** (and reduced to **medium** in the absence of seapens).

2.11.2.16 The brittlestar beds IEF is deemed to be of high vulnerability and medium recoverability and of national value. Based on assessments made by the MarESA, it is of overall medium sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance (**Table 2.18**). The sensitivity of the receptor is considered to be **medium**.

Fylde MCZ

2.11.2.17 The sensitivity of the Fylde MCZ IEFs (i.e. subtidal sand IEF and subtidal mud IEF) to temporary habitat loss/disturbance are presented in **Table 2.18**. These sensitivities are based on assessments made by the MarESA for the constituent biotopes.

2.11.2.18 The subtidal sand IEF is representative of the same feature which is a designated feature of the Fylde MCZ. The Supplementary Advice on Conservation Objectives for the Fylde MCZ (Natural England, 2023) identified the biotopes *Moerella* spp. with venerid bivalves in infralittoral gravelly sand SS.SCS.ICS.MoeVen and *Glycera lapidum* in impoverished infralittoral mobile gravel and sand SS.SCS.ICS.Glap in association with this feature of the MCZ. The site specific surveys for the Transmission Assets also identified SS.SSa.CMuSa.AalbNuc within the overlap with the MCZ.

2.11.2.19 The Supplementary Advice on Conservation Objectives for the Fylde MCZ (Natural England, 2023) identified the biotope SS.SMu.CSaMu.AfilKurAnit in association with the subtidal mud IEF feature of the MCZ. The SS.SSa.IMuSa.EcorEns and SS.SMu.CSaMu.LkorPpel were identified in subsequent baseline surveys (Environment Agency and Natural England, 2015) as well as the site specific surveys for the Transmission Assets. These biotopes have a low to medium sensitivity to penetration and surface abrasion and medium sensitivity to removal of substratum (see **Table 2.18**). The majority of these communities are infaunal which offers some protection against surface level disturbance (De-Bastos and Hill, 2023a; De-Bastos and Hill, 2023b). The species which characterise these biotopes are predominantly infaunal burrowing species such as echinoderms, polychaetes and bivalves such as *A. filiformis* and *E. cordatum*, which are capable of re-entering the substratum following disturbance (De-Bastos and Hill, 2023a).

2.11.2.20 The SS.SMu.CSaMu.LkorPpel biotope is characterised by the opportunistic *Lagis koreni*, which has been noted as dominant at a dredged material site in Liverpool Bay (Whomerslwey *et al*., 2008) and the similarly opportunistic *P. pellucidus* which also dominates dredge spoil dump sites (Rees *et al*., 1992). Dernie *et al*. (2003) found that muddy sand habitats had the longest recovery times, compared to mud and clean sand habitats, the specific recovery time will depend on the species present. Brittlestar *A. filiformis* is able to repair arms, has long dispersal potential, but is slow growing and takes two years to reach maturity. So where the majority of the population remain, and/or recruitment by adult mobility is possible, resilience is likely to be high and recovery rapid. Where recovery through juvenile recruitment is required, however, recovery would be dependent on favourable hydrodynamic conditions which could lead to a longer recovery time (De-Bastos and Hill, 2023a; De-Bastos and Hill, 2023b). Recovery is likely to occur between two and ten years after cable installation (De-Bastos and Hill, 2023a; De-Bastos and Hill, 2023b). Some species however are capable of much quicker recovery, for example Hiddink *et al*. (2006) reported direct mortality of up to 31% of *L. koreni* caused by a single passage of a trawl. *L. koreni* is however short-lived, reaches maturity quickly, within one year, and is capable of rapid recolonisation through larval recruitment following disturbance events, and reaches former densities within a year (Arntz and Rumohr, 1986).

2.11.2.21 The subtidal sand IEF is deemed to be of medium vulnerability and high recoverability and, based on assessments made by the MarESA, is of overall low to medium sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance. The subtidal sand IEF is of national value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.14**. The sensitivity of the receptor is considered to be **medium**.

2.11.2.22 The subtidal mud IEF is deemed to be of medium to very high vulnerability and high to medium recoverability and, based on assessments made by the MarESA, is of overall low to medium sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance. The subtidal mud IEF is of national value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.14**. The sensitivity of the receptor is considered to be **medium**.

Intertidal habitat IEFs

2.11.2.23 The sensitivities of the intertidal habitat IEFs to temporary habitat loss/disturbance are presented in **Table 2.18**. These sensitivities are based on assessments made by the MarESA for the constituent biotopes.

2.11.2.24 The species poor/barren sands IEF has no sensitivity to medium sensitivity to this impact due to the paucity of macrofauna. The biotopes present in this IEF are composed of disturbed and well sorted sands, the associated species are generally present in low abundances and adapted to frequent disturbance (Ashley and Watson, 2024). The highly mobile species present occasionally in these biotopes are likely be found in extremely low abundance. Overall the impact of abrasion and penetration is likely to be minimal. The removal of sediment will have a minimal temporary impact on these biotopes as the sediment will be replaced upon completion of the installation activities. High sedimentation is also unlikely to have a negative impact as the sediment deposited will be of a similar composition to that already at the landfall (Ashley and Watson, 2024).

2.11.2.25 The Polychaete/bivalve-dominated muddy sand shores IEF is composed of the LS.LSa.MuSa, LS.LSa.MuSa.MacAre and LS.LSa.MuSa.Lan biotopes, which range from not sensitive to high sensitivity to the defined MarESA pressures. Specifically, the LS.LSa.MuSa.Lan biotope has no sensitivity to abrasion or penetration, due to *L. conchilega* living within robust, flexible tubes which can retract below the surface in the event of disturbance and are able to repair their tubes rapidly if damaged (Nickolaidou, 2003). Due to this, discrete disturbance events have been shown to have no significant impact on *L. conchilega* density (Rabaut *et al*., 2008). However, if the disturbance involves dumping or extraction over 30 cm in depth, all benthic species are likely to be removed from or covered in the affected area, although recovery is expected based on local hydrodynamics (Van Hoey *et al*., 2008). The LS.LSa.MuSa.MacAre has mostly medium sensitivity to disturbance pressures due to the characteristic species typically being buried down to 30 cm and having high recovery capacity in disturbed environments (McLusky *et al*., 1983). The characterising species are however highly sensitive to penetration of the substratum, due to being entirely infaunal (Newell *et al*., 1998).

2.11.2.26 The *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF has a low to medium sensitivity to the defined MarESA pressures. This IEF is characterised by the common heart urchin *E. cordatum* and the bivalve *Ensis*, both of which can be found close to the surface of the seabed making them sensitive to abrasion and particularly penetration of the seabed. Bergman and van Santbrink (2000) suggested that *E. cordatum* was one of the most vulnerable species to disturbance such as trawling. Bivalves such as Ensis spp. has been reported to be relatively resistant possibly given their ability to burrow deeper into the sediment (Bergman and van Santbrink, 2000). This community is unlikely to be able to be resistant to the removal of substratum and extraction of substratum to 30 cm is likely to result in the removal of the biological community (De-Bastos and Hill, 2023b). Due to their infaunal life style both of these characterising species are likely to be able to move within deposited sediment and unbury themselves if necessary (De-Bastos and Hill, 2023b). Recruitment of subtidal populations of *E. cordatum* is often sporadic with reports of recruitment in only three years over a 10 year period (Buchanan, 1966), with intertidal individuals reproducing more frequently. *E. ensis* is also a long-lived species, taking a relatively long time, three years, to reach reproductive maturity (Henderson and Richardson, 1994). This would indicate a slow recovery period. The disturbance of discreet corridors for cable installation is unlikely to result in a long term adverse impact on either of these populations in the east Irish Sea.

2.11.2.27 The species poor/barren sands IEF is deemed to be of low to very high vulnerability and high recoverability and, based on assessments made by the MarESA, will range from not sensitive to medium sensitivity overall to the MarESA pressures associated with temporary habitat loss/disturbance. The species poor/barren sands IEF is of national value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.14**. The sensitivity of the receptor is considered to be **medium**.

2.11.2.28 The polychaete/bivalve-dominated muddy sand shores IEF is deemed to be of very high to low vulnerability and high to medium recoverability and, based on assessments made by the MarESA, is of overall not sensitive to high sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance (noting the high sensitivity is only applicable to the LS.LSa.MuSa.MacAre biotope and the pressure of 'penetration or disturbance of the substratum subsurface', all other sensitives are medium or lower). The polychaete/bivalve-dominated muddy sand shores IEF is of national value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.14** The sensitivity of the receptor is considered to be **medium**.

2.11.2.29 The *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is deemed to be of very high to low vulnerability and high to medium recoverability and, based on assessments made by the MarESA, is of overall low to medium sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance. The polychaete/bivalve-dominated muddy sand shores IEF is of national value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.14**. The sensitivity of the receptor is considered to be **medium**.

Table 2.18: Sensitivity of the benthic IEFs to temporary habitat loss/disturbance

IEF	Representative biotope	Sensitivity to defined MarESA pressure				Overall sensitivity (based on Table 2.14)
		Habitat structure changes - removal of substratum	Abrasion/ disturbance of the surface of the substratum or seabed	Penetration or disturbance of the substratum subsurface	Smothering and siltation rate changes (heavy)	
Subtidal habitats						
Subtidal coarse and mixed sediments with diverse benthic communities	SS.SCS.CCS SS.SMx.OMx SS.SMx.OMx.PoVen	Medium	Low	Low	Medium	Medium
	SS.SMx.CMx.KurThyMx	Medium	Low	Low	Low	
Subtidal muddy sands with relatively species poor benthic communities	SS.SMu.CMuSa SS.SMu.CSaMu.LkorPpel	Medium	Low	Low	Low	Medium
	SS.SMu.CSaMu.AfilKurAnit	Medium	Medium	Medium	Medium	
Seapens and burrowing megafauna communities	SS.SMu.CFiMu.SpnMeg	High	Medium	High	Not sensitive	High (although in the absence of seapens sensitivity is considered to be Medium)
Subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities	SS.SSa.IFiSa SS.SSa.CFiSa SS.SSa.CFiSa.EpusOborApri	Medium	Low	Low	Medium	Medium
	SS.SSa.CMuSa.AalbNuc	Medium	Low	Low	Medium	
	SS.SSa.CFiSa.ApriBatPo	Medium	Low	Low	Medium	
Brittlestar beds	SS.SMx.CMx.OphMx	Medium	Medium	Medium	Medium	Medium

IEF	Representative biotope	Sensitivity to defined MarESA pressure				Overall sensitivity (based on Table 2.14)
		Habitat structure changes - removal of substratum	Abrasion/ disturbance of the surface of the substratum or seabed	Penetration or disturbance of the substratum subsurface	Smothering and siltation rate changes (heavy)	
Broadscale habitats: features of Fylde MCZ						
Subtidal mud	SS.SMu.CSaMu.AfilKurAnit SS.SSa.CMuSa	Medium	Medium	Medium	Medium	Medium
	SS.SSa.IMuSa.EcorEns	Medium	Medium	Medium	Low	
	SS.SMu.CSaMu.LkorPpel	Medium	Low	Low	Low	
Subtidal sand	SS.SCS.ICS.Glap	Medium	Low	Low	Medium	Medium
	SS.SCS.ICS.MoeVen	Medium	Low	Low	Medium	
	SS.SSa.CMuSa.AalbNuc	Medium	Low	Low	Medium	
Intertidal habitats						
Species poor/barren sands	LS.LSa.FiSa	Medium	Low	Low	Low	Medium
	LS.LSa.MoSa	Medium	Not sensitive	Not sensitive	Not sensitive	
Polychaete/bivalve-dominated muddy sand shores	LS.LSa.MuSa LS.LSa.MuSa.MacAre	Medium	Medium	High	Medium	Medium
	LS.LSa.MuSa.Lan	Medium	Not sensitive	Not sensitive	Low	

IEF	Representative biotope	Sensitivity to defined MarESA pressure				Overall sensitivity (based on Table 2.14)
		Habitat structure changes - removal of substratum	Abrasion/ disturbance of the surface of the substratum or seabed	Penetration or disturbance of the substratum subsurface	Smothering and siltation rate changes (heavy)	
Echinocardium cordatum and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand	SS.SSa.IMuSa.EcorEns	Medium	Medium	Medium	Low	Medium

Magnitude of impact

Subtidal habitat IEFs

2.11.2.30 The installation of the Transmission Assets infrastructure within the Offshore Order Limits may lead to up to 14,805,472 m^2 of temporary subtidal habitat loss/disturbance during the construction phase (**Table 2.12**). This equates to approximately 2.40% of the Offshore Order Limits and 0.075% of the study area.

2.11.2.31 Temporary habitat disturbance in the construction phase is likely to result from pre-lay preparations (sandwave, boulder and debris clearance and associated deposition), UXO clearance, cable installation (subtidal), cable removal and jack-up operations. Long term and permanent habitat loss associated with the cable protection is considered in **section 2.11.5**. The MDS for these impacts is the sequential construction scenario (i.e. site preparation and construction will take place over a maximum of 30 months, noting that there is potential for a gap between the construction periods for Morgan (21 months) and Morecambe (9 months)) as this equates to the greatest time over which disturbance may occur. Although it should be noted that the total extent of habitat disturbance is the same for both the concurrent and sequential scenarios.

2.11.2.32 The amount of temporary habitat disturbance/loss has decreased following post-PEIR refinements made to the MDS primarily as a result of a reduction in the width of the area affected by sandwave clearance, from 104 m to 60 m for the Morgan export cables and from 104 m to 48 m for the Morecambe export cables. This has led to a decrease in temporary habitat disturbance/loss associated with this activity. For example, the area affected by the deposition of sandwave clearance material has decreased from 18,624,330 m^2 to 2,853,600 m^2 post-PEIR. The MDS for total temporary habitat loss/disturbance in the PEIR was up to 64,029,330 m^2 which has reduced to 14,805,472 m^2 in the ES which equates to a 76.88% reduction in design parameters for this impact following project design refinements post- PEIR.

2.11.2.33 During boulder clearance, any boulders identified as likely to impact installation will need to be moved to the side (i.e. sidecast), away from the immediate location of the cable infrastructure. As outlined in Volume 1, Chapter 3: Project description of the ES, there are two key methods of clearing boulders, boulder plough and boulder grab. Where a high density of boulders is seen, the expectation is that a plough will be required to clear the cable installation corridor. Where medium and low densities of boulders are present, a subsea grab is expected to be employed. Boulder clearance will occur within the footprint of other site preparation activities and the activity has been considered as temporary habitat disturbance (rather than loss) as the process will effectively redistribute boulders and cobbles within discrete areas. Given the patchiness of the distribution of boulders in the survey area, this is considered unlikely to represent a significant shift in the baseline and, since no sediment/substrate is being removed, this will not act as a barrier for the recovery of any epifaunal communities impacted during the process. Furthermore, the MDS assumes that all of the habitat within the boulder clearance corridor will be disturbed (i.e. the situation in the event that a plough us used) but, in reality, it is likely that some parts will only require clearance via a subsea grab. This methodology would be more targeted and would result in less habitat disturbance than that assumed for the MDS.

2.11.2.34 As outlined in Volume 1, Chapter 3: Project description of the ES, it should be noted that when undertaking sandwave clearance, the material will be sidecast to a location adjacent to the sandwave clearance to allow this material to be available for migration and sandwave recovery. CoT116 (**Table 2.11)** highlights the commitment to depositing material arising from sandwave clearance within the Offshore Order Limits in close proximity to the works and within the licences disposal sites within the Offshore Order Limits. Any mounds of cleared material will most likely be deposited within the area disturbed and then erode over time, and displaced material will re-join the natural sedimentary environment, gradually reducing the size of the mounds. As the sediment type deposited on the seabed will be similar to that of the surrounding areas (CoT116, **Table 2.11**), benthic assemblages would be expected to recolonise these areas. A sandwave recoverability study associated with the cable trenching activities of the Race Bank Offshore Wind Farm, showed that within two years of export cable trenching operations, sandwaves affected within the Inner Dowsing, Race Bank and North Ridge SAC had mostly recovered to pre-construction levels (Orsted, 2018).

2.11.2.35 A Crown Estate study reviewed the effects of cable installation on subtidal sediments and habitats, drawing on monitoring reports from over 20 UK offshore wind farms (RPS, 2019). This review showed that sandy sediments recover quickly following cable installation (e.g. months to one to two years; Newell *et al*., 2004), with little or no evidence of disturbance in the years following cable installation. It also presented evidence that remnant cable trenches in coarse and mixed sediments were conspicuous for several years after installation. However, these shallow depressions were of limited depth (i.e. tens of centimetres) relative to the surrounding seabed, over a horizontal distance of several metres and therefore did not represent a large shift from the baseline environment (RPS, 2019). Remnant trenches (and anchor drag marks) were observed years following cable installation within areas of muddy sand sediments, although these were relatively shallow features (i.e. a few tens of centimetres). Offshore wind farms such as Ormonde and Gunfleet Sands 1, 2 and 3, identified shallow (i.e. a few tens of centimetres) remnant trenches in the years following cable installation within areas of muddy sand sediments. Evidence suggests that damage to muddy habitats can persist for up to a year before the habitat recovers to an undisturbed state (Kaiser *et al*., 2006), while other sandier habitats tend to infill and recover to previous conditions in shorter time periods, dependent on the underlying sediment and habitat (Reiss *et al*., 2009). These timeframes, relative to the construction period and overall lifetime of the Transmission Assets, are considered to be short, and indicate relatively rapid recovery to otherwise undisturbed environmental conditions.

2.11.2.36 In addition to the impact of pre-lay preparations and trenching for cable installation, jack-up events associated with the pull-in of the offshore export cables will result in compression of seabed sediments beneath spud cans where these are placed on the seabed. This is estimated to disturb a total of up to 192 m^2 of seabed habitat across all jack-up events. It should be noted that the area associated with each jack-up event is very small (16 m^2), and considerably smaller than jack-ups required for the installation of wind turbine foundations for offshore wind farm projects. These depressions will infill over time, although may remain visible for a number of years following construction (BOWind, 2008; EGS, 2011; Centrica Energy, 2016). Monitoring at the Barrow offshore wind farm showed depressions were almost entirely infilled 12 months after construction (BOWind, 2008). Monitoring at the Lynn and Inner Dowsing offshore wind farm also showed some infilling of the footprints, although the depressions were still visible four years post-construction (Centrica Energy, 2016).

2.11.2.37 The MDS also includes the clearance of up to 25 UXOs within the Transmission Assets with a 250 kg UXO considered the most likely (common) maximum. Studies undertaken for the Norfolk Vanguard offshore wind farm (Ordtek, 2018) considered the likely crater sizes for a range of UXOs. For the smallest UXO considered (55 kg which is greater than the minimum considered for the Transmission Assets), the likely diameter of the crater was estimated at 8.91 m and a likely depth of 1.3 m. For a 150 kg UXO (the option most similar to the most likely maximum for the Transmission Assets) the likely diameter of the crater was estimated at 12.61 m and a likely depth of 1.8 to 2.8 m. The Applicants are committed to applying low order/low yield techniques where safe and logistically viable to do so (CoT64, **Table 2.11**) and therefore UXO clearance will most likely be within the 20 m of disturbance assumed for cable burial (including boulder clearance) and also the width of disturbance assumed for sandwave clearance. UXO clearance will therefore be within the 20 m width of disturbance assumed for cable burial (including boulder clearance) and also the 60 m width assumed for sandwave clearance. Any craters created during detonation are expected to backfill by natural processes, the speed of which would depend on the sediment transport regimes in the area.

2.11.2.38 The subtidal habitat IEFs mostly likely to be affected by this impact are those which are sedimentary based. The majority of sandwave clearance and cable installation will take place within the subtidal muddy sands with relatively species poor benthic communities IEF due to this being the most widely represented sediment type throughout the survey area. This habitat is likely to recover from activities of this nature, as detailed in **paragraph 2.11.2.8**.

2.11.2.39 The maximum duration of the offshore construction phase for the Transmission Assets is up to four years, within which construction activities are anticipated to occur intermittently.

2.11.2.40 The impact is predicted to be of local spatial extent and medium term duration for the subtidal habitat IEFs. The magnitude is therefore **low**.

Fylde MCZ

2.11.2.41 The Fylde MCZ overlaps with the Offshore Order Limits and therefore some temporary habitat loss/disturbance may occur within the MCZ. The total area of the MCZ is 260.60 km^2 (Natural England, 2019) and, the MDS assumes that up to 88 km of export cables (i.e. four Morgan export cables each up to 16 km in length and two Morecambe export cables each up to 12 km in length) may be installed within the MCZ which all could require sandwave clearance and/or pre-lay preparation (i.e. boulder clearance) prior to installation (noting that this is precautionary and that not all cables within the MCZ are likely to require site preparation). Initial surveys indicate that the Fylde MCZ is largely featureless with some minor extent of ripples and pitted seabed with limited wave height (further details are provided in the Outline Offshore CSIP, document reference J15, and the Outline CBRA, document reference J14 submitted with the Application). Currently, it is not anticipated that exhaustive seabed levelling or sandwave clearance would be required within the MCZ, with an estimate that up to 5% of the export cables within the MCZ may require sandwave clearance (CoT47, **Table 2.11**). The MDS also assumes up to six jack-up events may be required within the Fylde MCZ, to support cable pull-in at the landfall (affecting up to 96 m^2 of seabed in total across all six jack-up events). However, as outlined in CoT117 (**Table 2.11**), the Applicants are committed to ensuring that any jack-up vessels within the Fylde MCZ will be stationary, and no walking jack-ups will be used within the Fylde MCZ.

2.11.2.42 The MDS is for up to 2,497,196 m^2 of temporary habitat loss/disturbance within the Fylde MCZ, which equates to 0.96% of the total area of the Fylde MCZ. Proportionally, this is predicted to affect up to 940,705 m^2 of the subtidal mud IEF (equating to 2.13% of the total area of the subtidal mud feature in the MCZ) and 1,556,491 m^2 of the subtidal sand IEF (equating to 0.72% of the total area of the subtidal sand feature in the MCZ). These values have reduced following project refinement post-PEIR, with the cable lengths reducing from 94.8 km to 88 km, and the total temporary habitat loss reducing from 8,532,443 m^2 to 2,497,196 m^2.

2.11.2.43 Based on current information, there is only one known buried UXO within the Offshore Order Limits, and this is outside the boundary of the Fylde MCZ. However a precautionary approach has been adopted which assumes that up to four UXOs may be require clearance in the Fylde MCZ, with the potential magnitude outlined in **paragraph 2.11.2.36**.

2.11.2.44 As noted in **paragraph 2.11.2.34**, research had indicated that subtidal sand and mud sediments are likely to recover from the construction activities associated with the Transmission Assets. Recovery will likely be quicker for sands and muds may experience remnant trenches in the years following cable installation.

2.11.2.45 Additionally, CoT115 (**Table 2.24**) highlights the Applicants' commitment to producing an OIPMP which will include provisions for the monitoring of the recovery of sediments and benthic communities within representative areas of the Fylde MCZ affected by sandwave clearance, cable installation and cable protection, at appropriate temporal intervals as part of the operational asset integrity surveys.

2.11.2.46 The impact is predicted to be of local spatial extent and medium-term duration for both the features of the Fylde MCZ. The magnitude is therefore **low**.

Intertidal habitat IEFs

2.11.2.47 As outlined in **Table 2.12**, the installation of up to six export cables within the intertidal area at the landfall, via open cut trenching and marinised trencher techniques (including working areas and intermediate pulling platforms), may result in up to 451,632 m^2 of temporary habitat loss/disturbance.

2.11.2.48 Temporary disturbance to intertidal habitat IEFs across the whole landfall area may also arise as a result of the movement of machinery, equipment, vehicles and personnel as well as barge vessel grounding. These activities are likely to result in surface level abrasion and disturbance or compaction of sediments, although only in the short term. The MDS also includes up to two intermediate pulling platforms per cable in the intertidal to support cable installation activities.

2.11.2.49 The impact is predicted to be of local spatial extent and short term duration. The magnitude of impact is therefore **negligible**.

Significance of the effect

Subtidal habitat IEFs

2.11.2.50 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF and the brittlestar beds IEF, the sensitivity of the receptor is **medium** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant.

2.11.2.51 Overall, for the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is **high**, but reduced to medium in the absence of seapens, and the magnitude is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This has been concluded due to the absence of seapens reducing the sensitivity of the IEF to medium as well as the relatively localised scale of this potential impact in this phase of the Transmission Assets as well as the small scale of the disturbance expected.

Fylde MCZ

2.11.2.52 Overall for the subtidal sand IEF and subtidal mud IEF of the Fylde MCZ, the sensitivity of the receptor is **medium** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant.

2.11.2.53 The effects of temporary habitat loss/disturbance on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference: E4).

Intertidal habitat IEFs

2.11.2.54 Overall, for the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF, the sensitivity of the receptor is **medium** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been reached based on the localised and intermittent nature of this potential impact in this phase of the Transmission Assets as well as the small scale of the disturbance expected in the intertidal zone.

Operation and maintenance phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.2.55 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance during the operation and maintenance phase is as described for the construction phase in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

2.11.2.56 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

2.11.2.57 The sensitivity of the brittlestar beds IEF is **medium**.

2.11.2.58 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

2.11.2.59 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

2.11.2.60 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Fylde MCZ

2.11.2.61 The sensitivities of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ are as described previously for the construction phase assessment in **paragraphs 2.11.2.17** and **2.11.2.22** and **Table 2.18**.

2.11.2.62 The sensitivities of the subtidal sand IEF and the subtidal mud IEF are **medium**.

Intertidal habitat IEFs

2.11.2.63 The sensitivity of the intertidal habitat IEFs to temporary habitat disturbance during the operation and maintenance phase is as described for the construction phase in **paragraphs 2.11.2.23** to **2.11.2.29** and **Table 2.18**.

2.11.2.64 The sensitivity of the species poor/barren sands IEF is **medium**.

2.11.2.65 The sensitivity of the Polychaete/bivalve-dominated muddy sand shores IEF is **medium**.

2.11.2.66 The sensitivity of the *Echinocardium cordatum* and *Ensis* spp. In lower shore and shallow sublittoral slightly muddy fine sand IEF is **medium**.

Magnitude of impact

Subtidal habitat IEFs

2.11.2.67 Operation and maintenance activities within the Transmission Assets (i.e. subtidal cable repair/reburial events and jack-up events to support intertidal cable repairs) will result in temporary habitat loss/disturbance. The MDS in **Table 2.12** accounts for up to 4,397,680 m^2 of temporary habitat disturbance within this phase. This equates to a small proportion (0.71%) of the Offshore Order Limits and 0.02% of the study area. It should also be noted that only a very small proportion of the total temporary habitat loss/disturbance is likely to occur at any one time over the 35 year operational lifetime and each maintenance event will be highly localised.

2.11.2.68 The repair and reburial of subtidal export cables, and jack-up events, will affect benthic habitats in the immediate vicinity of these operations, with effects on seabed habitats and associated benthic communities expected to be similar to the construction phase. The spatial extent of this impact is small in relation to the total study area although there is the potential for repeat disturbance to the habitats in the immediate vicinity of the cables because of these activities.

2.11.2.69 The impact is predicted to be of local extent and short term duration (intermittently occurring individual maintenance activities taking place over a period of days to weeks). The magnitude is therefore **low**.

Fylde MCZ

2.11.2.70 The Fylde MCZ overlaps with the Offshore Order Limits and therefore some temporary habitat disturbance may occur within the MCZ during the operation and maintenance phase as a result of subtidal cable repair and reburial events and jack-up events to support intertidal cable repairs. The overall figures for the spatial overlap are outlined in **paragraph 2.11.2.41**. The MDS for repair and reburial assumes up to seven remedial burial events (each affecting up to 2.56 km) and up to 14 repair events (each affecting 0.64 km) for the Morgan export cables over the Transmission Assets lifetime, and up to seven remedial reburial events (each affecting up to 0.972 km) and up to seven repair events (each affecting up to 1.144 km) for the Morecambe export cables. The MDS for jack-up events assumes there could be up to eight jack-up events in the MCZ over the 35 year operational lifetime. the area associated with each jack-up event is very small (16 m^2), and considerably smaller than jack-ups required for the installation of wind turbine foundations for offshore wind farm projects. Furthermore, intertidal repair events generally take between two to four weeks, with the jack-up vessel only required for a small proportion of this time. The jack-up events, if required, would be near the eastern boundary of the Fylde MCZ, where sediments are predominantly sandy (see Stage 1 MCZ Assessment, document reference E4). It is, therefore, reasonable to predict that the recovery of sediments within jack-up depressions in the Fylde MCZ would be in line with that observed at the neighbouring Barrow offshore wind farm (i.e. almost entirely infilled within 12 months) where sediments are comparable (i.e. muddy sands; RSK Environment Ltd. (2002)). Therefore, recovery of the sediments would be predicted in between jack-up events over the 35 year operational lifetime. As outlined in CoT115 in **Table 2.11**, the Applicants are committed to producing an OIPMP (document reference J20) which will include provisions for the monitoring of the recovery of sediments and benthic communities within representative areas of the Fylde MCZ affected by cable installation, at appropriate temporal intervals as part of the operational asset integrity surveys.

2.11.2.71 This could potentially result in temporary habitat disturbance of up to 834,024 m^2 (equating to 0.32% of the MCZ), with disturbance known to be sustained over the short-term up to a year after the impact in the muddy habitats (Kaiser *et al*., 2006), and potentially recovering prior to this depending on the underlying habitat type (Reiss *et al*., 2009). Proportionally, this is predicted to affect up to 314,181 m^2 of the subtidal mud IEF (equating to 0.71% of the total area of the subtidal mud feature in the MCZ) and 519,743 m^2 of the subtidal sand IEF (equating to 0.24% of the total area of the subtidal sand feature in the MCZ). These values have reduced following project refinement post-PEIR, with the total temporary habitat loss reducing from 5,390,000 m^2 to 834,024 m^2.

2.11.2.72 Over the 35-year lifetime of the Transmission Assets there may be repeat habitat disturbance every ten years for repair events and every five years for reburial events per cable. It is, however, anticipated that the communities will recover between these maintenance events. This approach is considered highly precautionary as not all repairs and reburial events will occur within the Fylde MCZ.

2.11.2.73 The impact is predicted to be of local spatial extent and short-term duration for both the features of the Fylde MCZ. The magnitude is therefore **low**.

Intertidal habitat IEFs

2.11.2.74 As detailed in **Table 2.12**, the repair and reburial of intertidal cables, together with jack-up events required to support these activities, may result in up to 553,680 m^2 of temporary intertidal habitat disturbance. The nature of this disturbance is likely to be similar to that experienced in the construction phase affecting the same habitats. The impact however will be of a lower magnitude and spread over a much longer time period, with repair events anticipated every ten years and reburial events every five years over the 35 year operational lifetime of the Transmission Assets.

2.11.2.75 The impact is predicted to be of local spatial extent and short-term duration for intertidal habitat IEFs. The magnitude is therefore **low**.

Significance of effect

Subtidal habitat IEFs

2.11.2.76 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF and the brittlestar beds IEF, the sensitivity of the receptor is **medium** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant.

2.11.2.77 Overall, for the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is high, but reduced to **medium** in the absence of seapens, and the magnitude is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This has been concluded due to the absence of seapens reducing the sensitivity of the IEF to medium as well as the relatively localised scale of this potential impact in this phase of the Transmission Assets as well as the small scale of the disturbance expected.

Fylde MCZ

2.11.2.78 Overall for the subtidal sand and subtidal mud features of the Fylde MCZ, the sensitivity of the receptor is **medium** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant.

2.11.2.79 The effects of temporary habitat loss/disturbance on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference E4).

Intertidal habitat IEFs

2.11.2.80 Overall, for the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF, the sensitivity of the receptor is **medium** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been reached based on the localised and intermittent nature of this potential impact in this phase of the Transmission Assets as well as the small scale of the disturbance expected in the intertidal zone.

Decommissioning phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.2.81 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance during decommissioning phase is as described for the construction phase in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

2.11.2.82 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

2.11.2.83 The sensitivity of the brittlestar beds IEF is **medium**.

2.11.2.84 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

2.11.2.85 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

2.11.2.86 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Fylde MCZ

2.11.2.87 The sensitivities of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ are as described previously for the construction phase assessment in **paragraphs 2.11.2.17** and **2.11.2.22** and **Table 2.18**.

2.11.2.88 The sensitivities of the subtidal sand IEF and the subtidal mud IEF are **medium**.

Intertidal habitat IEFs

2.11.2.89 The sensitivity of the intertidal habitat IEFs to temporary habitat disturbance is as described for the construction phase in **paragraphs 2.11.2.23** to **2.11.2.29** and **Table 2.18.**

2.11.2.90 The sensitivity of the species poor/barren sands IEF is **medium**.

2.11.2.91 The sensitivity of the polychaete/bivalve-dominated muddy sand shores IEF is **medium**.

2.11.2.92 The sensitivity of the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is **medium**.

Magnitude of impact

2.11.2.93 The MDS for the decommissioning phase assumes that all cables will be removed and that the decommissioning sequence will generally be a reverse of the construction sequence.

Subtidal habitat IEFs

2.11.2.94 The extent of temporary habitat disturbance to subtidal habitat IEFs that may occur as a result of decommissioning activities is predicted to be in line with that described for the construction phase in **paragraphs 2.11.2.30** to **2.11.2.40** (i.e. up to 14,805,472 m^2). On the basis that there will be no requirement for sandwave clearance or pre-lay preparation during decommissioning, the magnitude of the impact is likely to be lower than during construction.

2.11.2.95 The impact is predicted to be of local spatial extent and medium term duration. The magnitude is therefore **low**.

Fylde MCZ

2.11.2.96 The current preferred decommissioning approach to the offshore export cables is that they would be left *in situ*; however, a future scenario could exist where they may be retrieved. As outlined in **Table 2.11**, all external cable protection used within the Fylde MCZ to be designed to be removable on decommissioning (CoT108). The requirement for removal of cable protection within the Fylde MCZ will be agreed with stakeholders and regulators at the time of decommissioning (CoT109, **Table 2.11**). The removal of cables and cable protection has been as the worst case scenario for temporary habitat disturbance during the decommissioning phase.

2.11.2.97 The extent of temporary habitat disturbance to IEFs within the Fylde MCZ, that may occur within the MCZ during the decommissioning phase, is therefore predicted to be up to 1,760,000 m^2. The only activity in the decommissioning phase of this project will be the removal of subtidal export cable and cable protection.

2.11.2.98 The impact is predicted to be of local spatial extent and medium-term duration for both the features of the Fylde MCZ. The magnitude is therefore **low**.

Intertidal habitat IEFs

2.11.2.99 The extent of temporary habitat disturbance to intertidal habitat IEFs that may occur as a result of decommissioning activities (i.e. removal of the export cables in the intertidal) is predicted to be in line with that described for the construction phase in **paragraph 2.11.2.47** to **2.11.2.49**.

2.11.2.100 The impact is predicted to be of local spatial extent and medium term duration. The magnitude is therefore **negligible**.

Significance of effect

Subtidal habitat IEFs

2.11.2.101 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF and the brittlestar beds IEF, the sensitivity of the receptor is **medium** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant.

2.11.2.102 Overall, for the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is **high**, but reduced to medium in the absence of seapens, and the magnitude is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This has been concluded due to the absence of seapens reducing the sensitivity of the IEF to medium as well as the relatively localised scale of this potential impact in this phase of the Transmission Assets as well as the small scale of the disturbance expected.

Fylde MCZ

2.11.2.103 Overall for the subtidal sand IEF and subtidal mud IEF features of the Fylde MCZ, the sensitivity of the receptor is **medium** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant.

2.11.2.104 The effects of temporary habitat loss/disturbance on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference E4).

Intertidal habitat IEFs

2.11.2.105 Overall, for the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF, the sensitivity of the receptor is **medium** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been reached based on the localised and intermittent nature of this potential impact in this phase of the Transmission Assets as well as the small scale of the disturbance expected from the decommissioning phase.

2.11.3 Increased suspended sediment concentrations and associated deposition

2.11.3.1 Increases of SSC and associated deposition are predicted to occur during the construction, operation and maintenance, and decommissioning phases as a result of sandwave clearance activities and the installation, repair and removal of export cables.

2.11.3.2 The benchmarks for the relevant MarESA pressures which have been used to inform this impact assessment are:

- changes in suspended solids (water clarity): the benchmark for which is a change in one rank on the Water Framework Directive scale (e.g. from clear to intermediate for one year, caused by activities disturbing sediment or organic particulate material and mobilising it into the water column such as dredging, disposal at sea, cable and pipeline burial); and

- smothering and siltation rate changes (light): the benchmark for light deposition is up to 5 cm of fine material added to the habitat in a single discrete event.

2.11.3.3 With regards to background SSC, the Cefas Climatology Report 2016 (Cefas, 2016) and associated dataset provides the spatial distribution of average non-algal Suspended Particulate Matter (SPM) for the majority of the UK Continental Shelf. Between 1998 and 2005, the greatest plumes were associated with large rivers such as those that discharge into the Thames Estuary, The Wash and Liverpool Bay, which showed mean values of SPM above 30 mg/l. Based on the data provided within this study, the SPM associated with the Transmission Assets has been estimated as approximately 2 mg/l offshore to 40 mg/l inshore over the 1998-2015 period. Higher levels of SPM are experienced more commonly in the winter months; however, due to the tidal influence, even during summer months the levels remain elevated.

2.11.3.4 The principal mechanisms governing SSC in the water column are tidal currents, with fluctuations observed across the spring-neap cycle and across the different tidal stages (high water, peak ebb, low water, peak flood). It is important to note that SSCs can also be temporarily elevated by wave driven currents during storm events. During high-energy storm events, levels of SSC can rise significantly, both near bed and extending into the water column. Following storm events, SSC levels will gradually decrease to baseline levels, regulated by the ambient regional tidal regimes. The seasonal nature and frequency of storm events supports a broadly seasonal pattern for SSC levels.

2.11.3.5 Sediments in the Irish Sea have been reported, on average, to experience mobilisation 35% of the time during a year (Couglan and Stips, 2015).

2.11.3.6 Seabed preparation activities (e.g. sandwave and boulder, debris clearance and out of service cable removal) will occur in advance of installation of the offshore cables. Pre-lay ploughed material will be disposed of within the Transmission Assets and is considered in the Outline Dredging and disposal - site characterisation plan (document reference: J22), whilst any debris will be taken ashore for disposal, with this detailed in the.

Construction phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.3.7 The sensitivities of the subtidal habitat IEFs to increased SSCs and associated deposition are presented in **Table 2.19**. These are based on MarESA pressure assessments of the constituent biotopes.

2.11.3.8 The subtidal coarse and mixed sediments with diverse benthic communities IEF has no to low sensitivity to increased SSC and sediment deposition (see **Table 2.19**). In particular, the component biotope SS.SMx.CMx.KurThyMx of this IEF is not sensitive as the characterising species *K. bidentata* occurs frequently in highly turbid estuaries and is therefore adapted to high levels of suspended sediments, and also most other characterising species are mobile and tolerant of burial of up to 50 cm (Essink, 1999). The characteristic communities associated with the sedimentary habitats are largely adapted for burrowing, for example Powilleit *et al*., (2009) studied the response of the polychaete *Nephtys hombergii* to smothering. This species successfully migrated to the surface of 32-41 cm deposited sediment layer of till or sand/till mixture and restored contact with the overlying water. In general bivalves and polychaetes in these habitats are likely to be able to survive short periods under sediments and to reposition (Tillin, 2023b), especially with the aid of strong currents to rapidly re-distribute sediment. An increase in suspended sediment may have a deleterious effect on the suspension feeding community. An increase in suspended solids may have a negative effect on growth and fecundity by reducing filter feeding efficiency but the characterising species of these biotopes are likely to be tolerant to short-term increases in turbidity following sediment mobilization by storms and other events (Tillin, 2023b).

2.11.3.9 The biotopes representative of the subtidal muddy sands with relatively species poor benthic communities IEF have no sensitivity to the MarESA pressures associated with increased SSC and sediment deposition (see **Table 2.19**). Changes in SSC and deposition can occur naturally in these habitats as a result of changes in hydrodynamics (De-Bastos, 2016). Increases in suspended sediment may lead to reduced feeding or respiration for filter feeders as their feeding apparatus or gills can get clogged (De-Bastos, 2016). An increase in suspended particulates and subsequent increased deposition of organic matter will increase food resources to deposit feeders which can result in changes in community composition (De-Bastos, 2023). Specifically, a relatively small increase in suspended sediments would increase the food available to many of the benthic deposit feeders within these communities, potentially leading to increased population limits (Hargrave, 1980) and having no negative impact on populations. Low levels of sediment deposition and potential smothering is unlikely to impact the characterising species of any of these biotopes, with *O. ophiura* tolerant of burial events noted with survival for up to 32 days (Last *et al*., 2011), and opportunistic species such as *L. koreni* benefitting from the disturbance caused by burial of other species (Whomerslwey *et al*., 2008), indicating no sensitivity for any of the component biotopes of the subtidal muddy sands with relatively species poor benthic communities IEF.

2.11.3.10 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF includes the biotopes SS.SSa.IFiSa, Circalittoral fine sand SS.SSa.CFiSa, SS.SSa.CFiSa.EpusOborApri, SS.SSa.CMuSa.AalbNuc and SS.SSa.CFiSa.ApriBatPo which were all assessed as having low sensitivity to increased SSC and sediment deposition (see **Table 2.19**), with the expected burrowing behaviours of the characterising bivalve and polychaete species allowing survival of these organisms when water clarity is reduced or siltation is light (Essink, 1999). The sensitivity to smothering and siltation rate changes (light) is low due to the possibility of concentrations >250 mg/l potentially limiting bivalve growth temporarily (Widdows *et al*., 1979), although this is unlikely to occur for long for this IEF.

2.11.3.11 The low resemblance stony reefs IEF are assessed by the MarESA as having no sensitivity to this pressure (**Table 2.19**). Whilst increases in SSCs may result in extra energetic expenditure in cleaning, it is unlikely to increase mortality for the characteristic species (Readman, 2016). Deposition of 5 cm may bury some of the characterising species, however the biotope experiences moderate water flow and sediment is likely to be removed rapidly. Additionally, this biotope is sand scoured and occasional disposition events are likely to occur which the biotic community is likely to be adapted for.

2.11.3.12 The brittlestar beds IEF has an overall medium sensitivity to increases in SSC and associated deposition (**Table 2.19**). The brittlestar beds IEF is not sensitive to changes in water clarity as brittlestars are passive suspension feeders and a significant supply of suspended organic material is needed to meet the energetic costs of the great numbers of individuals in a brittlestar bed (De-Bastos *et al*., 2023). An increase in SSC rich in organic material would therefore be beneficial to brittlestars, however an increase in SSC involving primarily non-organic particles may interfere with the feeding of brittlestars (Aronson, 1992). Brittlestar beds occur in a variety of conditions and are likely to be tolerant to a variety of SSCs (De-Bastos *et al*., 2020). The potential effects associated with light smothering can include abrasion and clogging of gills, impaired respiration, clogging of filter mechanisms, and reduced feeding and pumping rates (De-Bastos *et al*., 2023), these effects will abate following the re-distribution of material. Furthermore, dense beds of brittlestars tend not to persist in areas of excessive sedimentation, because high levels of sediment foul the brittlestars feeding apparatus and ultimately suffocates them (Aronson, 1992).

2.11.3.13 The seapens and burrowing megafauna IEF is also well adapted to its sedimentary habitat and is often subject to high suspended sediment loads although feeding apparatus may be clogged (Hill *et al*., 2023). Once siltation levels return to normal, feeding will be resumed therefore recovery is likely to be immediate. Furthermore, both *P. phosphorea* and *V. mirabilis* can burrow and move into and out of their own burrows. It is probable therefore that deposition of up to 5 cm of fine sediment will have little effect on these communities. *P. phosphorea* and *F. quadrangularis* were found to recover within 72 to 96 hours after experimental smothering by pots or creels for 24 hours (Kinnear *et al*., 1996). Where present, the characteristic burrowing megafauna (such as mud-shrimp and *Nephrops*) are unlikely to be affected adversely as they are active burrowers.

2.11.3.14 Seapen species often live in sheltered areas, in fine sediments, subject to high suspended sediment loads. The effect of increased deposition of fine silt is uncertain but it is possible that feeding structures may become clogged. When tested, the seapen *V. mirabilis* quickly seized and rejected inert particles (Hoare and Wilson, 1977). Once siltation levels return to normal, feeding will be resumed therefore recovery will be immediate. However, seapens were not identified in the site-specific surveys for the Transmission Assets.

2.11.3.15 The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of low to medium vulnerability, high recoverability and, based on assessments made by the MarESA, is of overall negligible to low sensitivity to the MarESA pressures associated with increased SSC and sediment deposition (**Table 2.19**). The IEF is of national value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.14**. The sensitivity of the receptor is considered to be **low**.

2.11.3.16 The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**. This is based on the methodology described in **section 2.10.2**, where IEFs which are known to have no sensitivity to the impact are deemed to have a negligible sensitivity.

2.11.3.17 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of medium vulnerability, high recoverability, and national value. The sensitivity of the receptor is **low**.

2.11.3.18 The low resemblance stony reef IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**. This is based on the methodology described in **section 2.10.2**, where IEFs which are known to have no sensitivity to the impact are deemed to have a negligible sensitivity.

2.11.3.19 The brittlestar beds IEF is deemed of high vulnerability, medium recoverability and of national value. The sensitivity of the receptor is therefore, considered to be **medium.**

2.11.3.20 The seapens and burrowing megafauna IEF is deemed to be of low vulnerability, high recoverability and national value. This IEF is deemed to not be sensitive to this impact. The sensitivity of the seapens and burrowing megafauna IEF is therefore **negligible**. This is based on the methodology described in **section 2.10.2**, where IEFs which are known to have no sensitivity to the impact (see **Table 2.19**) are deemed to have a negligible sensitivity.

Shell Flat and Lune Deep SAC

2.11.3.21 The sensitivity of the Shell Flat and Lune Deep SAC IEFs to increased SSCs and associated deposition are presented in **Table 2.19**. These sensitivities are based on assessments made by the MarESA for the constituent biotopes.

2.11.3.22 The sandbanks which are slightly covered by sea water IEF all the time of the Shell Flat and Lune Deep SAC is characterised by the

SS.SSa.CMuSa.AalbNuc biotope, *Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand (SS.SSa.IMuSa.FfabMag) biotope and *Kurtiella bidentata* and *Abra* spp. in infralittoral sandy mud (SS.SMu.ISaMu.KurAbr) biotope. All of these biotopes have a low to no sensitivity to the changes in suspended solids and light smothering and siltation rate change pressure associated with this impact. A decrease in water quality at this site may lead to a decrease in primary production indirectly affecting food availability for filter feeders (Tillin and Rayment, 2022). The increase in suspended sediments associated with these activities is temporary and therefore unlikely to result in an adverse impact on primary production. Furthermore, the deposition of fine materials may reduce the suitability of this habitat for its key species as well as the clogging of feeding organs for species such as *K. bidentata*. This effect is however likely to be temporary and some species such as *K. bidentata* are able to change their feeding mode to accommodate this change in conditions (De-Bastos, 2023). Additionally, these characterising species are burrowing species highly capable of repositioning themselves to the seabed surface following light smothering. Essink (1999) indicated that the maximal overburden through which *E. cordatum* could migrate was approximately 30 cm in sand and bivalves have been found to burrow to the surface following the deposition of up to 41 cm of sediment (Powilleit *et al*., 2009).

2.11.3.23 The reef IEF of the Shell Flat and Lune Deep SAC is characterised by mixed faunal turf communities such as the biotopes *Flustra foliacea* and colonial ascidians on tide-swept exposed circalittoral mixed substrata CR.HCR.xFa.FluCoAs.X and *Flustra foliacea* and *Haliclona (Haliclona) oculata* with a rich faunal turf on tide-swept circalittoral mixed substrata CR.HCR.xFa.FluHocu. Both of these biotopes have a low to no sensitivity to the changes in suspended solids and light smothering and siltation rate change pressure associated with this impact. These biotopes are dominated by suspension feeders whose feeding apparatus may be temporarily clogged by an increase in suspended solids; however, these communities have been described on tide swept exposed seabeds and therefore can be exposed to periodic, temporary light smothering suggesting that they are likely resistant to this impact (Holme and Wilson, 1985). Schönberg (2015) provides one such example by reviewing and observing the interactions between sediments and marine sponges her findings were that whilst many sponges are disadvantaged by sedimentation, many examples exist of sponges adapting to sediment presence, including living, at least partially, embedded within the sediment. Overall, an increase in SSC as well as the level of deposition is unlikely to result in long term adverse impacts on these biotopes (Readman, 2016a; Readman 2016b).

2.11.3.24 The sandbanks which are slightly covered by sea water IEF is deemed to be of medium vulnerability and high recoverability and, based on assessments made by the MarESA, is of overall no to low sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance. The sandbanks which are slightly covered by sea water IEF is of international value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.19**. The sensitivity of the receptor is considered to be **low**.

2.11.3.25 The reef IEF is deemed to be of medium vulnerability and high recoverability and, based on assessments made by the MarESA, is of overall no to low sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance. The reef IEF is of international value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.19**. The sensitivity of the receptor is considered to be **low**.

Fylde MCZ

2.11.3.26 The sensitivity of the Fylde MCZ IEFs to increased SSCs and associated deposition are presented in **Table 2.19**. These sensitivities are based on assessments made by the MarESA for the constituent biotopes.

2.11.3.27 The representative biotopes of the subtidal sand IEF of the Fylde MCZ are indicated by the MarESA as having a low sensitivity to the changes in suspended solids and light smothering and siltation rate change pressure associated with this impact. The infaunal organisms associated with this feature, such as *Nephtys* sp., *Glycera* sp., *Spiophanes bombyx* and *L. latreilli*, are unlikely to be affected by these changes as they are not affected by water clarity and are highly likely to be able to survive burial of this magnitude (Tillin, 2022; Tillin, 2023a). Bivalves of these biotopes, such as *Timoclea ovata*, however are suspension feeders which filter food through delicate structure which could be clogged by an increase in suspended solids (Tillin, 2022). It is likely however that the characterising suspension and filter feeders would be tolerant of a short term increase in suspended sediment such as would be experienced as a result of a storm (Tillin, 2022; Tillin, 2023a; Tillin and Budd, 2023). Most bivalve species are also capable of surviving short periods of burial and reposition themselves in the sediment, for example *A. alba* are capable of upwardly migrating if lightly buried by additional sediment (Schafer, 1972). Kranz (1972) noted that shallowly buried siphoned suspension feeders could reposition themselves following smothering by 10-50 cm of their native sediment.

2.11.3.28 The representative biotopes of the subtidal mud IEF of the Fylde MCZ are indicated by the MarESA as being not sensitive to the changes in suspended solids and light smothering, and siltation rate change pressure associated with this impact. The key species of these biotopes including the brittlestar *A. filiformis*, bivalves *K. bidentata* and the echinoderm *E. cordatum* are suspension and deposit feeders which rely on a steady source of sedimentary material. Reductions in water clarity are therefore unlikely to adversely affect these communities and may increase food availability (De-Bastos and Hill, 202316b). Furthermore, many bivalves, such as those which are characteristic of these biotopes, are capable of repositioning themselves in sediment following smothering, examples are described in **paragraph 2.11.3.21**. One such practical examples is *L. koreni* which was reported as dominant at a dredged-material ground in Liverpool Bay (Whomerslwey *et al*., 2008). Similarly, Rees *et al*. (1992) report that *P. pellucidus* can become dominant in areas where dredge spoil is dumped, demonstrating high resilience to the pressures exerted by this impact.

2.11.3.29 The subtidal sand IEF is deemed to be of medium vulnerability and high recoverability and, based on assessments made by the MarESA, is of overall no to low sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance. The subtidal sand IEF is of national value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.19**. The sensitivity of the receptor is considered to be **low**.

2.11.3.30 The subtidal mud IEF is deemed to be of low vulnerability and high recoverability and, based on assessments made by the MarESA, overall lower has no sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance. The subtidal mud IEF is of national value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.19**. The sensitivity of the receptor is considered to be **negligible**.

West of Walney MCZ

2.11.3.31 The sensitivity of the West of Walney MCZ IEFs to increased SSCs and associated deposition are presented in **Table 2.19**. These sensitivities are based on assessments made by the MarESA for the constituent biotopes.

2.11.3.32 The subtidal mud IEF and subtidal sand IEF of the West of Walney MCZ can both be represented by the SS.SMu.CSaMu.AfilKurAnit biotope which has been mapped across the West of Walney MCZ (Clements and Service, 2016). Clogging of feeding apparatus by suspended sediment is likely to be the main consideration for the characterising species of the biotopes, which include a number of suspension feeders, such as brittlestar *A. filiformis*, and bivalves *K. bidentata (*De-Bastos and Hill, 2016a).202316a). The biotopes are characterised by burrowing species that are likely to be able to burrow upwards and therefore unlikely to be adversely affected by smothering of up to 5 cm sediment (De-Bastos and Hill, 2016a). Polychaetes such as *Nephtys* and *Nereis* have been reported as tolerant of burial by up to 50 cm of mud and up to 80 cm of sand (Essink, 1999). The subtidal sand IEF of the West of Walney MCZ is also represented by the SS.SMx.CMx.KurThyMx biotope, the sensitivity of which is detailed in **paragraph 2.11.3.20**.

2.11.3.33 The seapens and burrowing megafauna IEF of the West of Walney MCZ is likely to have the same sensitivity to increases in SSC and associated deposition as described previously for the subtidal habitat IEFs in **paragraph 2.11.3.13**.

2.11.3.34 The subtidal sand IEF of the West of Walney MCZ is deemed to be of low to medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. This is based on the methodology described in **section 2.10.2**, where IEFs which are known to have no sensitivity to the impact (see **Table 2.19**) are deemed to have a negligible sensitivity.

2.11.3.35 The subtidal mud IEF of the West of Walney MCZ is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. This is based on the methodology described in **section 2.10.2**, where IEFs which are known to have no sensitivity to the impact (see **Table 2.19**) are deemed to have a negligible sensitivity.

2.11.3.36 The seapens and burrowing megafauna IEF of the West of Walney MCZ is deemed to be of low vulnerability, high recoverability and national value. This IEF is therefore deemed to not be sensitive to this impact. The sensitivity of the seapens and burrowing megafauna IEF is therefore **negligible**. This is based on the methodology described in **section 2.10.2**, where IEFs which are known to have no sensitivity to the impact (see **Table 2.19**) are deemed to have a negligible sensitivity.

West of Copeland MCZ

2.11.3.37 The subtidal coarse sediment IEF of the West of Copeland MCZ was not assigned a biotope based on surveys undertaken in support of the designation and therefore the proxy SS.SCS.CCS.MedLumVen has been used. In general bivalves and polychaetes in these habitats are likely to be able to survive short periods under sediments and to reposition (Tillin, 2023b), especially with the aid of strong currents to rapidly re-distribute sediment. An increase in SSCs may have a negative effect on the suspension feeding, growth and fecundity but the characterising species of these biotopes are likely to be tolerant to short-term increases in turbidity following sediment mobilization by storms and other events (Tillin, 2023b).

2.11.3.38 The sensitivity of the subtidal mixed sediment IEF of the West of Copeland MCZ is as described in **paragraph 2.11.3.20**. The sensitivity of the subtidal sand IEF of the West of Copeland MCZ is as described in **paragraph 2.11.3.34**.

2.11.3.39 The subtidal coarse sediment IEF of the West of Copeland MCZ is deemed to be of medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

2.11.3.40 The subtidal mixed sediment IEF of the West of Copeland MCZ is deemed to be of medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

2.11.3.41 The subtidal sand IEF of the West of Copeland MCZ is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

Intertidal habitat IEFs

2.11.3.42 The sensitivity of the intertidal habitat IEFs to increased SSCs and associated deposition are presented in **Table 2.19**. These sensitivities are based on assessments made by the MarESA for the constituent biotopes.

2.11.3.43 The species poor/barren sands IEF is comprised of the biotopes LS.LSa.FiSa and LS.LSa.MoSa which have been assessed to have no sensitivity to these MarESA pressures. Amphipods may be regular swimmers within the surf plankton, where the concentration of suspended particles would be expected to be higher (Fincham, 1970), indicating a low sensitivity to increases in SSC, while any infaunal species would either be typically buried and not sensitive to this impact, or able to burrow to the surface if buried (Essink, 1999).

2.11.3.44 Polychaete/bivalve-dominated muddy sand shores IEF is composed of the LS.LSa.MuSa, LS.LSa.MuSa.MacAre and LS.LSa.MuSa.Lan biotopes, which have been assessed to be not sensitive to these MarESA pressures (**Table 2.19**). Specifically, one of the characterising species *L. conchilega* is able to switch from suspension to deposit feeding dependent on water siltation rates (Buhr and Winter, 1977), indicating a high resilience to this pressure. Also, several intertidal species such as *A. marina* and *M. balthica* live buried in sediment down to 40 cm (Volkenborn and Reise, 2006), and thus will have no sensitivity to further burial due to being adapted to these conditions. Also, *E. cordatum* has been recorded in high densities in fine material dump sites (Probert, 1981), indicating a resistance to siltation. *Ensis ensis* and other *Ensis* species are known to be resistant to siltation (Holme, 1954), and can burrow through directly deposited material (Fish and Fish, 1996),

2.11.3.45 The species poor/barren sands IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**.

2.11.3.46 The polychaete/bivalve-dominated muddy sand shores IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**.

2.11.3.47 The *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**.

Table 2.19: Sensitivity of the benthic subtidal and intertidal habitat IEFs to increased SSCs and associated deposition

IEF	Representative biotope	Sensitivity to defined MarESA pressure		Overall sensitivity (based on Table 2.14)
		Changes in suspended solids (water clarity)	Smothering and siltation rate changes (light)	
Subtidal habitats				
Subtidal coarse and mixed sediments with diverse benthic communities.	SS.SCS.CCS SS.SMx.OMx SS.SMx.OMx.PoVen	Low	Low	Low
	SS.SMx.CMx.KurThyMx	Not sensitive	Not sensitive	
Subtidal muddy sands with relatively species poor benthic communities.	SS.SMu.CMuSa SS.SMu.CSaMu.LkorPpel	Not sensitive	Not sensitive	Negligible
	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	Not sensitive	
Seapens and burrowing megafauna communities	Potential SS.SMu.CFiMu.SpnMeg	Not sensitive	Not sensitive	Negligible
Subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities.	SS.SSa.IFiSa SS.SSa.CFiSa SS.SSa.CFiSa.EpusOborApri	Low	Low	Low
	SS.SSa.CMuSa.AalbNuc	Low	Low	
	SS.SSa.CFiSa.ApriBatPo	Low	Low	
Low resemblance stony reef	CR.HCR.xFa.SpNemAdia	Not sensitive	Not sensitive	Negligible
Brittlestar beds	SS.SMx.CMx.OphMx	Not sensitive	Medium	Medium

IEF	Representative biotope	Sensitivity to defined MarESA pressure		Overall sensitivity (based on Table 2.14)
		Changes in suspended solids (water clarity)	Smothering and siltation rate changes (light)	
Annex I habitat features of SACs				
Sandbanks which are slightly covered by sea water all the time	SS.SSa.CMuSa.AalbNuc	Low	Low	Low
	SS.SSa.IMuSa.FfabMag	Low	Low	
	SS.SMu.ISaMu.KurAbr	Low	Not sensitive	
Reefs	CR.HCR.XFa.FluCoAs.X	Not sensitive	Low	Low
	CR.HCR.XFa.FluHocu	Not sensitive	Low	
Broadscale habitats: features of MCZs				
Subtidal mud	SS.SMu.CSaMu.AfilKurAnit (Fylde MCZ and West of Walney MCZ)	Not sensitive	Not sensitive	Negligible (Fylde MCZ) Negligible (West of Walney MCZ)
	SS.SSa.IMuSa.EcorEns (Fylde MCZ)	Not sensitive	Not sensitive	
	SS.SMu.CSaMu.LkorPpel (Fylde MCZ)	Not sensitive	Not sensitive	
Subtidal sand	SS.SMu.CSaMu.AfilKurAnit (West of Walney MCZ and West of Copeland MCZ)	Not sensitive	Not sensitive	Low (Fylde MCZ and West of Copeland MCZ)

IEF	Representative biotope	Sensitivity to defined MarESA pressure		Overall sensitivity (based on Table 2.14)
		Changes in suspended solids (water clarity)	Smothering and siltation rate changes (light)	
	SS.SCS.ICS.Glap (Fylde MCZ)	Not sensitive	Low	Negligible (West of Walney MCZ) Negligible (West of Copeland MCZ)
	SS.SCS.ICS.MoeVen (Fylde MCZ)	Low	Low	
	SS.SSa.CMuSa.AalbNuc (Fylde MCZ)	Low	Low	
	SS.SMx.CMx.KurThyMx (West of Walney MCZ)	Not sensitive	Not sensitive	
Subtidal coarse sediment	SS.SCS.CCS (West of Copeland MCZ)	Low	Low	Low
Subtidal mixed sediment	SS.SMx.OMx (West of Copeland MCZ) SS.SMx.OMx.PoVen (West of Copeland MCZ)	Low	Low	Low
Seapens and burrowing megafauna communities	SS.SMu.CFiMu.SpnMeg (West of Walney)	Not sensitive	Not sensitive	Negligible
Intertidal habitats				
Species poor/barren sands	LS.LSa.FiSa LS.LSa.MoSa	Not sensitive	Not sensitive	Negligible
Polychaete/bivalve-dominated muddy sand shores.	LS.LSa.MuSa LS.LSa.MuSa.MacAre	Not sensitive	Not sensitive	Negligible
	LS.LSa.MuSa.Lan	Not sensitive	Not sensitive	

IEF	Representative biotope	Sensitivity to defined MarESA pressure		Overall sensitivity (based on Table 2.14)
		Changes in suspended solids (water clarity)	Smothering and siltation rate changes (light)	
Echinocardium cordatum and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand.	SS.SSa.IMuSa.EcorEns.	Not sensitive	Not sensitive	Negligible

Magnitude of impact

Subtidal habitat IEFs

2.11.3.48 The physical processes assessment has been undertaken using an evidence-based conceptual approach using existing modelling studies and assessments, and is presented in full in Volume 2, Chapter 1: Physical processes of the ES. The assessment was informed by the modelling studies undertaken for the Morgan Offshore Wind Project: Generation Assets and other offshore wind project assessments (e.g. the Mona Offshore Wind Project). For the purposes of this assessment, site preparation sandwave clearance and cable installation have been considered (**Table 2.12**). The MDS for increases in SSC and associated deposition considers activities to be carried out concurrently.

2.11.3.49 With regards to cable installation, in practice, plough dredging mobilises a much smaller amount of sediment into suspension at the seabed and has reduced sediment plume concentrations and extents compared to other types of dredging activities which may be undertaken. However, the assessment is undertaken applying modelling carried out for the Morgan Offshore Wind Project: Generation Assets ES which simulated the use of a suction hopper dredger with a phasing representative of the scale of the sandwaves; dredging and then depositing material by side casting within the cable corridor as it progressed along the route, resulting in higher SSC and dispersion plumes compared to plough dredging.

2.11.3.50 Sandwave clearance operations mobilise the greatest volume of material when compared to the range of construction activities. The Morgan Offshore Wind Project: Generation Assets ES modelling undertook a sample of sandwave clearance along the north east corner of the Morgan Offshore Wind Project: Generation Assets and, with relatively homogeneous tidal currents and sediments along much of the offshore cable corridors where sandwaves occur, these simulations have been used to quantify potential impacts for the Transmission Assets. The sediment plume is predicted to extend approximately 5 km in a principally east/west orientation. Increases in SSC are at their greatest at the dredging site and where they have been remobilised following slack tide and may reach up to 1,000 mg/l. However average concentrations are typically one tenth of this value and near background levels at the edge of the plume’s extent. Sedimentation following the sandwave clearance is in the order of up to 3 to 5 mm across the region where material is redistributed and <0.1 mm at the extent of the plume.

2.11.3.51 However due to the nature of the site as an active bedform and its natural exposure to sediment redistribution, it is likely that the site would recover quickly. Analysis of inter-array cable installation activities modelled for the Morgan Offshore Wind Project (with the same 3 m width and depth) showed that sedimentation can be in excess of 50 mm at the trench site and decreasing with distance. This would however be trapped in the sediment cell and kept within the sediment transport system. Much of this material would backfill the trench. Additionally CoT116 (Table 1.11) highlights the Transmission Assets commitment to depositing material arising from sandwave clearance within the Offshore Order Limits in close proximity to the works and within the licences' disposal sites within the Offshore Order Limits which will limit the extent of the impact.

2.11.3.52 The installation of cabling relating to the Transmission Assets may lead to increased SSC and associated deposition (see **Table 2.12**). In each case, cables will be installed in a trench with a maximum depth of 3 m, a width of 3 m at the bed and a “v” shape cross-section. In total, cabling comprises of 484 km of offshore export cables.

2.11.3.53 The installation of export cables associated with the Morgan Offshore Wind Project: Generation Assets were modelled as part of the Morgan Offshore Wind Project: Generation Assets ES, the outputs of which can be seen in Volume 2, Annex 1.1: Physical processes associated modelling studies of the ES. As with the sandwave clearance, it is expected that cable installation activities will create a suspended sediment plume extending up to 5 km from the trenching operation. In the direct vicinity of the trenching, increases in SSC were typically 500 mg/l whilst at the extents of the plume levels were predicted to be considerably lower at 0.5 mg/l, which is in the order of background level variation. Sedimentation levels beyond the immediate vicinity of the trench were approximately 50 mm and reducing to <0.5 mm within 2 km. Much of the displaced material would, in reality, be used to backfill the trench.

2.11.3.54 Cabling along routes located to the south of the Morgan Offshore Wind Project: Generation Assets and extending to the east of the Morecambe Offshore Windfarm: Generation Assets where the offshore cables coalesce would not impact on this designated area. Deposition arising from cable installation and subsequent remobilisation and redistribution on the north routes would be indistinguishable from background levels at the adjacent MCZs. Trenching undertaken from the east edge of the Morecambe Offshore Windfarm: Generation Assets site towards the shore would pass through areas where the tidal currents are of a similar magnitude but are orientated north to south, parallel to the coastline.

2.11.3.55 It is possible that sandwave clearance activities may be undertaken simultaneously with cable installation activities. Given the mobile nature of sediment within the export cable corridor it is likely that sandwave clearance will occur in sections of the cable route just prior to cable trenching in that area, to avoid the newly formed channels from in-filling. Thus, it is likely that plumes from these activities will coalesce, and greater levels of SCC and deposition can be expected.

2.11.3.56 The impact is predicted to be of local spatial extent and short term duration. The magnitude is therefore **low**.

Shell Flat and Lune Deep SAC

2.11.3.57 Construction activities will not occur within the Shell Flat and Lune Deep SAC and so the designated features will not be directly affected. This designated site is, however, within one tidal excursion of the Transmission Assets.

2.11.3.58 Material remobilised and redistributed as a result of sandwave clearance activities for the Transmission Assets may reach the south edges the Shell Flat feature of the Shell Flat and Lune Deep SAC. However, the Shell Flat and Lune Deep SAC is located 5.7 km from the Transmission Assets and so, at this distance, the SAC is located beyond the suspended sediment plume which is predicted to extend up to 5 km. Therefore, the depths of sedimentation within the SAC would be indistinguishable from background levels. As discussed in **paragraph 2.11.3.54**, trenching undertaken landward from the east edge of the Morecambe Offshore Windfarm: Generation Assets passes through areas where the tidal currents are of a similar magnitude but are orientated north to south, parallel to the coastline. Redistributed sediment may therefore reach the south edge of Shell Flat feature of the Shell Flat and Lune Deep SAC but at levels which would be indistinguishable from background sediment.

2.11.3.59 The impact is predicted to be of local spatial extent and short-term duration for all the features of the Shell Flat and Lune Deep SAC. The magnitude is therefore **negligible**.

Fylde MCZ

2.11.3.60 Construction activities will occur within the Fylde MCZ and so designated features may be directly affected. Sandwave clearance activities will however be minimised within the Fylde MCZ as outlined by commitment CoT47 (**Table 2.11**) with the Outline Offshore CSIP (document reference J15) including measures to limit sandwave clearance to no more than 5% of the offshore export cable route within the Fylde MCZ.

2.11.3.61 The extent of plumes associated with sandwave clearance is described in **paragraphs 2.11.3.50** to **2.11.3.51**, however, the Fylde MCZ would experience greater levels of deposition when works are undertaken either in close proximity (< 10 km) or within the site.

2.11.3.62 Trenching through the Fylde MCZ would result in an impact with a magnitude the same as that described in **paragraph 2.11.3.53** with plumes oriented north to south.

2.11.3.63 As discussed in **paragraph 2.11.3.55**, it is possible that sandwave clearance activities may be undertaken simultaneously with cable installation activities. Given the mobile nature of sediment within the export cable corridor it is likely that sandwave clearance will occur in sections of the cable route just prior to cable trenching in that area, to avoid the newly formed channels from in-filling. Thus, it is likely that plumes from these activities will coalesce, and greater levels of SCC and deposition can be expected within the Fylde MCZ. This is the case not only for activities relating to the individual components of the Transmission Assets, i.e., sandwave clearance/cable installation activities relating to Morgan Offshore Wind Project: Transmission Assets, but also sandwave clearance/cable installation activities relating to the Morecambe Offshore Windfarm: Transmission Assets. Where this does occur, plumes will likely interact resulting in increased cumulative deposition within the Fylde MCZ. The nature of the site as an active seabed and its natural exposure to sediment redistribution, means it is likely that the MCZ would recover quickly from any sedimentation.

2.11.3.64 Additionally, CoT115 (**Table 2.24**) highlights the Applicants' commitment to producing an OIPMP which will include provisions for the monitoring of the recovery of sediments and benthic communities within representative areas of the Fylde MCZ affected by sandwave clearance, cable installation and cable protection, at appropriate temporal intervals as part of the operational asset integrity surveys.

2.11.3.65 The impact is predicted to be of local spatial extent and short-term duration for all the features of the Fylde MCZ. The magnitude is therefore **low**.

West of Walney MCZ

2.11.3.66 Construction activities will not occur within the West of Walney MCZ and so the designated features will not be directly affected. This designated site is, however, within one tidal excursion of the Transmission Assets.

2.11.3.67 Material remobilised and redistributed as a result of sandwave clearance activities for the Transmission Assets may reach the south edge of the West of Walney MCZ. However, the West of Walney MCZ is located 5.85 km from the Transmission Assets and so, at this distance, the SAC is located beyond the suspended sediment plume which is predicted to extend up to 5 km. Therefore, the depths of sedimentation within the MCZ would be indistinguishable from background levels.

2.11.3.68 Cabling along routes located to the south of the Morgan Offshore Wind Project: Generation Assets and extending to the east of the Morecambe Offshore Windfarm: Generation Assets where the offshore cables coalesce will not impact on the designated site. Deposition arising from cable installation and subsequent remobilisation and redistribution on the north routes would be indistinguishable from background levels at the West of Walney MCZ.

2.11.3.69 The impact is predicted to be of local spatial extent and short-term duration for all the features of the West of Walney MCZ. The magnitude is therefore **negligible**.

West of Copeland MCZ

2.11.3.70 Construction activities will not occur within the West of Walney MCZ and so the designated features will not be directly affected. This designated site is, however, within one tidal excursion of the Transmission Assets. The magnitude of the impact for the West of Copeland MCZ is as described in **paragraphs 2.11.3.66** to **2.11.3.69** for the West of Walney MCZ. As the West of Copeland MCZ is located 6.32 km from the Transmission Assets, the depths of sediment would also be indistinguishable from background levels.

2.11.3.71 The impact is predicted to be of local spatial extent and short-term duration for all the features of the West of Copeland MCZ. The magnitude is therefore **negligible**.

Intertidal habitat IEFs

2.11.3.72 The magnitude of the construction activities within the intertidal zone is likely to be a fraction of that of the subtidal area, and a plume will only occur when the area is wetted (i.e. at high tide). The plume itself is expected to be smaller and will likely rapidly integrate with suspended sediments routinely disturbed through the influence of tides and waves on the shore. The concentration of the plume would however be higher due to the reduced water column within which to dissipate but would be quickly deposited locally to the beach where it was disturbed from. Construction activities in the intertidal zone are however more often undertaken when the beach is dry or around low water, due to inherent risks of working close to the water's edge and in the path of the incoming tide.

2.11.3.73 Specifically, for cable trenching in the intertidal area material released may migrate within the sediment cell but it would be insufficient to impact the beach morphology, increasing baseline levels of sediment by approximately 5 -10 mm along the coast and typically far less along the shoreline which is redistributed on successive tides following cable installation.

2.11.3.74 Despite not being in the MDS in terms of SSC, there is potential that trenchless techniques namely direct pipe installation, to be utilised within the intertidal region. Direct Pipe would be undertaken from the TJBs at or near Blackpool Airport to the beach exit pit. Direct Pipe is a fully cased system which reduces the risks associated with frack out of drilling fluids or the collapse of the drill hole in the case of unsuitable ground conditions. In this scenario, up to 300 m of trenching per cable would still be required within the intertidal region dependent on the location of the direct pipe exit pits. The trench is likely to be a stepped side trench to maintain stability with a top width of up to 10 m and a depth of approximately 3 m.

2.11.3.75 The direct pipe exit pits would be located on the beach, possibly within the intertidal area. If they are required within the intertidal zone then works will most likely be undertaken at low tide utilising a cofferdam so that drilling can occur in a dry environment, mitigating suspended sediments. Any plume induced is therefore likely to have a similar spatial extent as expected for open-cut trenching in the vicinity, however, it should be noted that the volumes released, and hence SSC, would be much smaller.

2.11.3.76 The impact is predicted to be of local spatial extent and short-term duration for all the features of the intertidal habitat IEFs. The magnitude is therefore **negligible**.

Significance of effect

Subtidal habitat IEFs

2.11.3.77 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.

2.11.3.78 Overall, for the subtidal muddy sands with relatively species poor benthic communities IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.

2.11.3.79 Overall, for the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.

2.11.3.80 Overall, for the brittlestar beds IEF the sensitivity of the receptor is **medium**, and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** significance, which is not significant in EIA terms, due to the low concentrations of suspended sediment from construction activities which could impact this IEF

2.11.3.81 Overall, for the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.

2.11.3.82 Overall, for the low resemblance stony reef IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.

Shell Flat and Lune Deep SAC

2.11.3.83 Overall, for the sandbanks which are slightly covered by sea water IEF and reef IEF of the Shell Flat and Lune Deep SAC, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the distance between the SAC (5.7 km) and the Transmission Assets, which is greater than the predicted 5 km sediment plume, meaning sediment depths reaching the SAC would be indistinguishable from background levels, as well as the direction of the prevailing currents.

Fylde MCZ

2.11.3.84 Overall, for the subtidal sand IEF of the Fylde MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant, due to the relatively low levels of SSC from the small number of construction activities within the Fylde MCZ, and the sediment plume will dissipate to background levels within 5 km in most cases, and will be similar to existing baseline sediments.

2.11.3.85 Overall, for the subtidal mud IEF of the Fylde MCZ, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been reached due to the high resilience of the characteristic species of the biotopes of this IEF to the relevant pressures.

2.11.3.86 The effects of increased SSC and associated deposition on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference E4).

West of Walney MCZ

2.11.3.87 Overall, for the subtidal sand IEF, subtidal mud IEF and seapens and burrowing megafauna IEF of the West of Walney MCZ, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This is due to the West of Walney MCZ being located 5.85 km from the Transmission Assets, which is beyond the predicted 5 km sediment plume, with sediment depths within the MCZ therefore being indistinguishable from background levels.

West of Copeland MCZ

2.11.3.88 Overall, for the subtidal coarse sediment IEF and subtidal mixed sediment IEF of the West of Copeland MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the relatively low volumes of SSC, indistinguishable from background concentrations due to the distance of the MCZ from the Transmission Assets (6.32 km) exceeding the predicted 5 km sediment plume, which will overlap with the West of Copeland MCZ only intermittently during the construction phase.

2.11.3.89 Overall, for the subtidal sand IEF of the West of Copeland MCZ, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This is also due to the distance of the MCZ from the Transmission Assets, with sediment concentrations overlapping with the MCZ being indistinguishable from background levels.

Intertidal habitat IEFs

2.11.3.90 Overall, for the species poor/barren sands IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant.

2.11.3.91 Overall, for the polychaete/bivalve-dominated muddy sand shores IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant.

2.11.3.92 Overall, for the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant.

Operation and maintenance phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.3.93 The sensitivities of the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the low resemblance stony reef IEF, the brittlestar beds IEF and the seapens and burrowing megafauna communities IEF to increases in SSC and sediment deposition are as described previously for the construction phase assessment in **paragraphs 2.11.3.7** to **2.11.3.20** and **Table 2.19**.

2.11.3.94 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **low**.

2.11.3.95 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **negligible**.

2.11.3.96 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **low**.

2.11.3.97 The sensitivity of the brittlestar beds IEF is **medium**.

2.11.3.98 The sensitivity of the seapens and burrowing megafauna communities IEF is **negligible**.

2.11.3.99 The sensitivity of the low resemblance stony reef IEF is **negligible**.

Shell Flat and Lune Deep SAC

2.11.3.100 The sensitivities of the sandbanks which are slightly covered by sea water all the time IEF and the reef IEF are as described previously for the construction phase assessment in **paragraphs 2.11.3.21** to **2.11.3.25** and in **Table 2.19**.

2.11.3.101 The sensitivities of the sandbanks which are slightly covered by sea water IEF and the reef IEF of the Shell Flat and Lune Deep SAC are **low**.

Fylde MCZ

2.11.3.102 The sensitivities of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ are as described previously for the construction phase assessment in **paragraphs 2.11.3.26** and **2.11.3.30** and in **Table 2.19**.

2.11.3.103 The sensitivity of the subtidal sand IEF of the Fylde MCZ is **low**.

2.11.3.104 The sensitivity of the subtidal mud IEF of the Fylde MCZ is **negligible**.

West of Walney MCZ

2.11.3.105 The sensitivities of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF are as described previously for the construction phase assessment in **paragraphs 2.11.3.31** to **2.11.3.36** and in **Table 2.19**.

2.11.3.106 The sensitivities of the subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna IEF of the West of Walney MCZ are **negligible**.

West of Copeland MCZ

2.11.3.107 The sensitivities of the subtidal coarse sediment IEF, the subtidal mixed sediment IEF and the subtidal sand IEF are as described previously for the construction phase assessment in **paragraphs 2.11.3.37** to **2.11.3.41**. above in **Table 2.19**.

2.11.3.108 The sensitivities of the subtidal coarse sediment IEF and subtidal mixed sediment IEF of the West of Copeland MCZ are **low**.

2.11.3.109 The sensitivity of the subtidal sand IEF of the West if Copeland MCZ is **negligible**.

Intertidal habitat IEFs

2.11.3.110 The sensitivities of the species poor/barren sands IEF, polychaete/bivalve-dominated muddy sand shores IEF and *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF are as described previously for the construction phase assessment in **paragraphs 2.11.3.42** to **2.11.3.47** and **Table 2.19**.

2.11.3.111 The sensitivity of the species poor/barren sands IEF is **negligible**.

2.11.3.112 The sensitivity of the polychaete/bivalve-dominated muddy sand shores IEF is **negligible**.

2.11.3.113 The sensitivity of the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is **negligible**.

Magnitude of impact

Subtidal habitat IEFs

2.11.3.114 Operation and maintenance associated with the Transmission Assets may lead to increases in SSC and associated sediment deposition as per the MDS in **Table 2.12**. The Outline Offshore CSIP (document reference J15) applicable to cable installation and an Outline CBRA (document reference J14) will inform maintenance and reburial specification in line with project commitment CoT45, outlined in **Table 2.11**.

2.11.3.115 Repairs and reburial would be undertaken using similar methods as those for cable installation activities (i.e. trenching/jetting, with trench width up to 3 m and trench depth up to 3 m) but over much reduced distances per repair/reburial event. The magnitude of the impact would, therefore, be a fraction of those described in **paragraphs 2.11.3.48** to **2.11.3.56** for the construction phase. The sediment plumes and sedimentation footprints would be dependent on which section of the cable is being repaired however the entire length has been considered under the construction phase assessment.

2.11.3.116 The impact on subtidal habitat IEFs is predicted to be of local spatial extent, short term duration, intermittent and of high reversibility. The magnitude is therefore **negligible**.

Shell Flat and Lune Deep SAC

2.11.3.117 The Shell Flat and Lune Deep SAC is located 5.72 km from the Transmission Assets. Given this distance, the magnitude of the increase in SSCs and associated deposition within the Shell Flat and Lune Deep SAC is likely to be a fraction of that described for the construction phase in **paragraphs 2.11.3.57** to **2.11.3.59**.

2.11.3.118 The impact is predicted to be of local spatial extent, short term duration, intermittent and of high reversibility. The magnitude is therefore **negligible**.

Fylde MCZ

2.11.3.119 The Fylde MCZ overlaps with the Offshore Order Limits and therefore the IEFs will be directly affected by this impact. If cables repairs are undertaken within, or within 5 km of, the Fylde MCZ, then the nature of the impact would be as described for the construction phase in **paragraphs 2.11.3.60** to **2.11.3.65**. However, each repair/reburial event will only affect a very small area and such events will be highly localised and intermittent. The magnitude of the increase in SSCs and associated deposition within the Fylde MCZ is, therefore, likely to be a fraction of that described for the construction phase.

2.11.3.120 The impact is predicted to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

West of Walney MCZ

2.11.3.121 The magnitude of the increase in SSCs and associated deposition within the West of Walney MCZ is likely to be a fraction of that described for the construction phase in **paragraphs 2.11.3.66** to **2.11.3.69**.

2.11.3.122 The impact is predicted to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

West of Copeland MCZ

2.11.3.123 The magnitude of the increase in SSCs and associated deposition within the West of Copeland MCZ is likely to be a fraction of that described for the construction phase in **paragraph 2.11.3.70** to **2.11.3.71**.

2.11.3.124 The impact is predicted to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

Intertidal habitat IEFs

2.11.3.125 The magnitude of the increase in SSCs and associated deposition within the intertidal zone will likely be a fraction of that which occurs during the construction phase. Expected intertidal export cable repairs events may affect up to 1 km of Morgan export cables every ten years and 2.4 km of Morecambe export cables every ten years. Reburial events may affect up to 1 km of Morgan export cables in one event every five years and up to 500 m of Morecambe export cables in two events every five years (seven reburial events each the Morgan export cables and 14 reburial events for the Morecambe export cables).

2.11.3.126 The impact is predicted to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

Significance of effect

Subtidal habitat IEFs

2.11.3.127 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the low concentrations of suspended sediment from intermittent operation and maintenance activities which could impact this IEF.

2.11.3.128 Overall, for the subtidal muddy sands with relatively species poor benthic communities IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the low concentrations of suspended sediment from intermittent operation and maintenance activities which could impact this IEF.

2.11.3.129 Overall, for the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the low concentrations of suspended sediment from intermittent operation and maintenance activities which could impact this IEF.

2.11.3.130 Overall, for the brittlestar beds IEF, the sensitivity of the receptor is **medium** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the low concentrations of suspended sediment from intermittent operation and maintenance activities which could impact this IEF.

2.11.3.131 Overall, for the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the low concentrations of suspended sediment from intermittent operation and maintenance activities which could impact this IEF.

2.11.3.132 Overall, for the low resemblance stony reef IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the low concentrations of suspended sediment from intermittent operations and maintenance activities which could indirectly impact this IEF, which does not fall directly within the Transmission Assets.

Shell Flat and Lune Deep SAC

2.11.3.133 Overall for the sandbanks which are slightly covered by sea water IEF and the reef IEF of the Shell Flat and Lune Deep SAC, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible.** The effect will, therefore, be of **negligible** adverse significance, which is not significant due to the low concentrations of suspended sediment from intermittent operations and maintenance activities which could indirectly impact the IEFs.

Fylde MCZ

2.11.3.134 Overall for the subtidal sand IEF of the Fylde MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the low concentrations of suspended sediment within the Fylde MCZ from the intermittent operations and maintenance activities.

2.11.3.135 Overall for the subtidal mud IEF of the Fylde MCZ, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**.

The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the high resilience of the characteristic species of the biotopes of this IEF to the relevant pressures.

2.11.3.136 The effects of increased SSC and associated deposition on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference E4).

West of Walney MCZ

2.11.3.137 Overall for the subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna IEF of the West of Walney MCZ, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant.

West of Copeland MCZ

2.11.3.138 Overall for the subtidal coarse sediment IEF and subtidal mixed sediment IEF of the West of Copeland MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** significance, which is not significant, due to the low concentrations of suspended sediment within the West of Copeland MCZ from the intermittent operations and maintenance activities.

2.11.3.139 Overall for the subtidal sand IEF of the West of Copeland MCZ, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant.

Intertidal habitat IEFs

2.11.3.140 Overall, for the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant.

Decommissioning phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.3.141 The sensitivities of the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the low resemblance stony reef IEF, the brittlestar beds IEF and the seapens and burrowing megafauna communities IEF to increased SSC and sediment deposition are as described previous for the construction phase assessment in **paragraphs 2.11.3.7** to **2.11.3.20** and **Table 2.19**.

2.11.3.142 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **low**.

2.11.3.143 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **negligible**.

2.11.3.144 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **low**.

2.11.3.145 The sensitivity of the brittlestar beds IEF is **medium**.

2.11.3.146 The sensitivity of the seapens and burrowing megafauna communities IEF is **negligible**.

2.11.3.147 The sensitivity of the low resemblance stony reef IEF is **negligible**.

Shell Flat and Lune Deep SAC

2.11.3.148 The sensitivities of the sandbanks which are slightly covered by sea water all the time IEF and the reef IEF are as described previously for the construction phase assessment in **paragraphs 2.11.3.21** and **2.11.3.25** above in **Table 2.19**.

2.11.3.149 The sensitivities of the of the sandbanks which are slightly covered by sea water IEF and the reef IEF of the Shell Flat and Lune Deep SAC are **low**.

Fylde MCZ

2.11.3.150 The sensitivities of the subtidal sand IEF and the subtidal mud IEF are as described previously for the construction phase assessment in **paragraphs 2.11.3.26** and **2.11.3.30** above in **Table 2.19**.

2.11.3.151 The sensitivity of the subtidal sand IEF of Fylde MCZ is **low**.

2.11.3.152 The sensitivity of the subtidal mud IEF of Fylde MCZ is **negligible**.

West of Walney MCZ

2.11.3.153 The sensitivities of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF are as described previously for the construction phase assessment in **paragraphs 2.11.3.31** to **2.11.3.36** and above in **Table 2.19**.

2.11.3.154 The sensitivities of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF of the West of Walney MCZ are **negligible**.

West of Copeland MCZ

2.11.3.155 The sensitivities of the subtidal coarse sediment, the subtidal mixed sediment and the subtidal sand IEFs are as described previously for the construction phase assessment in **paragraphs 2.11.3.37** to **2.11.3.41** above in **Table 2.19**.

2.11.3.156 The sensitivities of the subtidal coarse sediment IEF and the subtidal mixed sediment IEF of the West of Copeland MCZ are **low**.

2.11.3.157 The sensitivity of the subtidal sand IEF of the West of Copeland MCZ is **negligible**.

Intertidal habitat IEFs

2.11.3.158 The sensitivities of the species poor/barren sands IEF, polychaete/bivalve-dominated muddy sand shores IEF and *Echinocardium cordatum* and *Ensis* spp. In lower shore and shallow sublittoral slightly muddy fine sand IEF are as described previously for the construction phase assessment in **paragraphs 2.11.3.42** to **2.11.3.47** and **Table 2.19**.

2.11.3.159 The sensitivity of the species poor/barren sands IEF is **negligible**.

2.11.3.160 The sensitivity of the polychaete/bivalve-dominated muddy sand shores IEF is **negligible**.

2.11.3.161 The sensitivity of the *Echinocardium cordatum* and *Ensis* spp. In lower shore and shallow sublittoral slightly muddy fine sand IEF is **negligible**.

Magnitude of impact

Subtidal habitat IEFs

2.11.3.162 The removal of project cabling would lead to an increase in SSC through similar trenching techniques as implemented during installation. Increases in SSC would be of a similar magnitude to those described for the construction phase in **paragraphs 2.11.3.48** to **2.11.3.56** but slightly reduced with the reduction in seabed preparation activities.

2.11.3.163 The impact is predicted to be of local spatial extent and short term duration. The magnitude is therefore **low**.

Shell Flat and Lune Deep SAC

2.11.3.164 The magnitude of the increase in SSC and associated deposition within the Shell Flat and Lune Deep SAC is likely to be a fraction of what is described for the subtidal habitat IEFs in **paragraphs 2.11.3.57** to **2.11.3.59**. The Shell Flat and Lune Deep SAC is located 5.72 km from the Transmission Assets, beyond the predicted 5 km sediment plume, with sediment depths beyond this being indistinguishable from background levels.

2.11.3.165 The impact is predicted to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

Fylde MCZ

2.11.3.166 The magnitude of the increase in SSC and associated deposition within the Fylde MCZ is likely to be similar to that described for the subtidal habitat IEFs in **paragraphs 2.11.3.60** to **2.11.3.65**.

2.11.3.167 The impact is predicted to be of local spatial extent and short term duration. The magnitude is therefore **low**.

West of Walney MCZ

2.11.3.168 The magnitude of the increase in SSC and associated deposition within the West of Walney MCZ is likely to be a fraction of what is described for the subtidal habitat IEFs in **paragraphs 2.11.3.66** to **2.11.3.69**. The West of Walney MCZ is located 5.85 km from the Transmission Assets, beyond the predicted 5 km sediment plume, with sediment depths beyond this being indistinguishable from background levels.

2.11.3.169 The impact is predicted to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

West of Copeland MCZ

2.11.3.170 The magnitude of the increase in SSC and associated deposition within the West of Copeland MCZ is likely to be a fraction of what is described for the subtidal habitat IEFs in **paragraphs 2.11.3.70** to **2.11.3.71**. The West of Copeland MCZ is located 6.32 km from the Transmission Assets, beyond the predicted 5 km sediment plume, with sediment depths beyond this being indistinguishable from background levels.

2.11.3.171 The impact is predicted to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

Intertidal habitat IEFs

2.11.3.172 The magnitude of increased SSC within the intertidal zone is likely to be minimal with buried cables currently planned to be removed and disposed of onshore with a magnitude consistent with or slightly lower than the construction phase activities.

2.11.3.173 The impact is predicted to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

Significance of effect

Subtidal habitat IEFs

2.11.3.174 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the short term and intermittent nature of the decommissioning activities causing very low levels of increases in SSC.

2.11.3.175 Overall, for the subtidal muddy sands with relatively species poor benthic communities IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due the short term and intermittent nature of the decommissioning activities and the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.

2.11.3.176 Overall, for the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the short term and intermittent nature of the decommissioning activities causing very low levels of increases in SSC.

2.11.3.177 Overall, for the brittlestar beds IEF, the sensitivity of the receptor is **medium** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant, due to the low concentrations of suspended sediment from intermittent decommissioning activities causing very low levels of increases in SSC which could impact this IEF.

2.11.3.178 Overall, for the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the low concentrations of suspended sediment from intermittent decommissioning activities causing very low levels of increases in SSC which could impact this IEF.

2.11.3.179 Overall, for the low resemblance stony reef IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the short term and intermittent decommissioning activities which will cause relatively low levels of SSC that will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.

Shell Flat and Lune Deep SAC

2.11.3.180 Overall for the sandbanks which are slightly covered by sea water IEF and the reef IEF of the Shell Flat and Lune Deep SAC, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** significance, which is not significant, due to the short term and intermittent nature of the decommissioning activities causing very low levels of increases in SSC.

Fylde MCZ

2.11.3.181 Overall for the subtidal sand IEF of the Fylde MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the short term and intermittent nature of the decommissioning activities causing very low levels of increases in SSC.

2.11.3.182 Overall for the subtidal mud IEF of the Fylde MCZ, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the high resilience of the characteristic species of the biotopes of this IEF to the relevant pressures and the short term and intermittent nature of the decommissioning activities which will cause very low levels of increases in SSC.

2.11.3.183 The effects of increased SSC and associated deposition on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference E4).

West of Walney MCZ

2.11.3.184 Overall for the subtidal sand IEF, subtidal mud IEF and seapens and burrowing megafauna IEF of the West of Walney MCZ, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant.

West of Copeland MCZ

2.11.3.185 Overall for the subtidal coarse sediment IEF and the subtidal mixed sediment IEF of the West of Copeland MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant, due to the short term and intermittent nature of the decommissioning activities causing very low levels of increases in SSC.

2.11.3.186 Overall for the subtidal sand IEF of the West of Copeland MCZ, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant.

Intertidal habitat IEFs

2.11.3.187 Overall, for the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. In lower shore and shallow sublittoral slightly muddy fine sand IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant.

2.11.4 Disturbance/remobilisation of sediment-bound contaminants

2.11.4.1 During activities such as sandwave clearance and cable installation/removal there is potential for sediment-bound contaminants such as metals, hydrocarbons and organic pollutants, to be remobilised into the water column and lead to adverse effects on benthic receptors.

2.11.4.2 The MarESA pressures and benchmarks relevant to these activities used to inform this impact assessment are listed below.

- Transitional elements and organometal contamination: Exposure of marine species or habitat to one or more relevant contaminants via uncontrolled releases or incidental spills. The increase in transition elements levels compared with background concentrations due to their input from land/riverine sources, by air or directly at sea.
- Hydrocarbon and PAH contamination: Exposure of marine species or habitat to one or more relevant contaminants via uncontrolled releases or incidental spills. Increases in the levels of these compounds compared with background concentrations.
- Synthetic compound contamination: Exposure of marine species or habitat to one or more relevant contaminants via uncontrolled releases or incidental spills. Increases in the levels of these compounds compared with background concentrations.

Construction phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.4.3 The sensitivity of the subtidal habitat IEFs to disturbance/remobilisation of sediment-bound contaminants are based on the information presented in the MarESA for the constituent biotopes whilst noting that a conclusion on the overall sensitivity to the relevant pressures is not presented in the MarESA for any biotope.

2.11.4.4 The disturbance/remobilisation of sediment-bound contaminants has the potential to affect all the subtidal habitat IEFs. Whilst the representative biotopes for the subtidal habitat IEFs are not assessed in the MarESA, in general, tolerance to heavy metals varies depending on species and tolerance tends to be low for most groups of benthic species in these IEFs. Bivalves are well known for their ability to accumulate heavy metals in their tissues, far in excess of environmental levels. Bryan (1984) states that mercury is the most toxic metal to bivalve molluscs when compared against environmental copper, cadmium and zinc. Stirling (1975) investigated the effects of copper exposure on *Tellina tenuis* and found exposure to copper concentrations of >250 µg/l inhibited burrowing behaviour, a similar response was noted for *Venerupis senegalensis* which stopped burying when exposed to high concentrations of copper (Kaschl and Carballeira, 1999). Other research has found some tolerance to contamination, for example, a study by Bryan (1989) found no demonstrable effect on polychaetes following exposure to contaminants such as cadmium. There are examples of the characteristic species *A. alba* living in contaminated sediments for example near Calais where sediments contain 8 mg/g iron and 4 mg/g titanium (Dewarumez *et al*., 1976).

2.11.4.5 Echinoderms such as those characterising the brittlestar beds IEF are also regarded as being intolerant of heavy metals (e.g. Bryan, 1984; Kinne, 1984) while polychaetes are generally tolerant (Bryan, 1984); however, no evidence exists of impacts from contaminants on this IEF specifically (De-Bastos *et al*., 2023). The results of the sediment chemistry analysis from the site-specific surveys concluded that levels across the survey area were generally low with some elevated levels of arsenic and mercury. Gounin *et al*. (1995) studied the transfer of heavy metals (iron, manganese, lead, copper and cadmium) through *Ophiothrix* beds. They concluded that heavy metals ingested or absorbed by the animals transited rapidly through the body and were expelled in the faeces and did not appear to accumulate in their tissues. The benthic communities have likely developed in an environment of existing contamination including elevated levels of arsenic and mercury and are therefore likely to have some tolerance to the absorption of these metals. Any release of contaminants from construction activities may therefore temporarily lead to an increase in concentration beyond the baseline; however, the concentration is then likely to be quickly diluted overall resulting in a minor and temporary increase in arsenic at levels which are unlikely to adversely affect the benthic communities present. Research on the effects of arsenic on benthic invertebrates found when exposed to arsenic treated water gastropod shells (*Nassarius obsoletus*) showed decreased consumption of food whereas bivalve shells *Mytilus edulis* showed mortality within 3 to 16 days of exposure (NAS, 1977).

2.11.4.6 The impact of hydrocarbon-based contaminants in the marine environment, such as PAHs and PCBs, is better understood. Suchanek (1993) reviewed the effects of oil spills on marine invertebrates and concluded that, in general, on soft sediment habitats, infaunal polychaetes, bivalves and amphipods were particularly affected. Echinoderms also seem to be especially intolerant of the toxic effects of oil, probably because of the large amount of exposed epidermis (Suchanek, 1993). During monitoring of sediments in the Ekofisk oilfield, Addy *et al*. (1978) suggested that reduced abundance of *A. filiformis* within 2-3 km of the oilfield was related to discharges of oil from the platforms and to physical disturbance of the sediment. Studies on specific species have found some tolerance, for example Hiscock *et al*. (2004 and 2005) described *Glycera* sp. As a very tolerant taxa, found in high abundances in the transitional zone along hydrocarbon contamination gradients surrounding oil platforms. It has also been noted that some species such as *A. alba* may benefit from the nutrient enrichment provided by contamination such as oil pollution (Dauvin, 1998). None of these studies however consider the effects of resuspended contaminants which may pose a more minor risk compared to the initial contamination events investigated in many of these studies. The levels of PCBs and PAHs were largely undetectable during the site-specific surveys and therefore exposure to such remobilised contaminants would be minimal.

2.11.4.7 The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.4.8 The brittlestar beds IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.4.9 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**, reduced to **medium** due to the absence of seapens.

2.11.4.10 The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.4.11 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.4.12 The low resemblance stony reef IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

Shell Flat and Lune Deep SAC

2.11.4.13 The sensitivity of the Shell Flat and Lune Deep IEFs to disturbance/remobilisation of sediment-bound contaminants are based on information presented in the MarESA for the constituent biotopes whilst noting that a conclusion on the overall sensitivity to the relevant pressures is not presented in the MarESA for any biotope.

2.11.4.14 The impact of remobilised contaminants on the sandbanks which are slightly covered by sea water all the time IEF of the Shell Flat and Lune Deep SAC has not been well assessed, and the MarESA does not provide a sensitivity assessment for the relevant biotopes. There is however research which provides some information on the impacts of some contaminants on the characterising species of the biotopes associated with this IEF, as summarised for the subtidal habitat IEFs in **paragraph 2.11.4.3** to **2.11.4.6**.

2.11.4.15 The impact of remobilised contaminants on the reef IEF of the Shell Flat and Lune Deep SAC has not been well assessed and the MarESA does not provide a sensitivity assessment for the relevant biotopes. Regarding the characterising groups within the representative biotopes, research suggests they are resistant to the adverse impacts associated with the remobilisation of contaminants. Bryozoans for example are known to bioaccumulate heavy metals (Holt *et al*., 1995), which can result in sublethal effects such as reduced reproduction. These effects were observed for the bryozoans *Bowerbankia gracialis* and *Nolella pusilla* which had bioaccumulated cadmium between 10-100 µg cadmium/l and fatality above 500 µg cadmium/l (Kayser, 1990). The severity of impacts can however depend on the species and the metal bioaccumulated. De Caralt *et al.* (2002) reported that *Clavelina lepadiformis* accumulated copper and lead, however neither reproduction nor growth were affected. Regarding oil-based contaminants such as PAHs and PCBs, filter feeders, such as bryozoans and sponges which are components of these communities, are highly sensitive to oil pollution (Zahn *et al*., 1981).

2.11.4.16 The sandbanks which are slightly covered by sea water IEF is deemed to be of low to medium vulnerability, high recoverability and international value. The sensitivity of the receptor is therefore, considered to be **low**.

2.11.4.17 The reef IEF is deemed to be of low to medium vulnerability, high recoverability and international value. The sensitivity of the receptor is therefore, considered to be **low**.

Fylde MCZ

2.11.4.18 The sensitivity of the Fylde MCZ IEFs to disturbance/remobilisation of sediment-bound contaminants are based on information presented in the MarESA for the constituent biotopes whilst noting that a conclusion on the overall sensitivity to the relevant pressures is not presented in the MarESA for any biotope.

2.11.4.19 The effects of disturbance/remobilisation of sediment-bound contaminants has not been widely assessed. The communities within the subtidal sand IEF are dominated by bivalves and polychaetes. This is similar to the other communities identified in the subtidal environment within the Transmission Assets study area which are assessed in **paragraphs 2.11.4.3** and **2.11.4.6**.

2.11.4.20 The communities within the subtidal mud IEF are dominated by bivalves, polychaetes and echinoderms. This is similar to the other communities identified in the subtidal environment within the Transmission Assets study area which are assessed in **paragraphs 2.11.4.3** and **2.11.4.6**.

2.11.4.21 The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

2.11.4.22 The subtidal mud IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

West of Walney MCZ

2.11.4.23 The sensitivity of the West of Walney MCZ IEFs to disturbance/remobilisation of sediment-bound contaminants are based on information presented in the MarESA for the constituent biotopes whilst noting that a conclusion on the overall sensitivity to the relevant pressures is not presented in the MarESA for most biotopes.

2.11.4.24 The sensitivity of the subtidal sand IEF and subtidal mud IEF is as described in **paragraphs 2.11.4.3** and **2.11.4.6**.

2.11.4.25 The seapens and burrowing megafauna communities IEF has not been specifically assessed in regard to exposure to transition elements such as arsenic as part of the MarESA. A review of the impact of contamination on Anthozoa found no direct evidence of an effect of transitional metals on seapens (Watson and Tyler-Walters, 2023). Reichelt-Brushett and Michalek-Wagner (2005) reported that fertilisation success in the octocoral *Lobophytum compactum* was more resistant to copper exposure than other species studies but also reported a significant decrease in fertilisation success. A decrease in fertilisation success due to copper might impair recruitment in seapens.

2.11.4.26 The key metal for the Transmission Assets is arsenic and the research has shown that arsenic can accumulate in the tissue of benthic organisms. Examples of this include the filter-feeding bivalves *C. edule* and *M. edulis*, which can accumulate arsenic from ingested living and dead particles leading to potential lethal effects at high concentrations (Neff, 2009). The concentrations of arsenic likely to be resuspended as a result of construction activities associated with the Transmission Assets however are unlikely to result in this level of bioaccumulation due to the short time period over which exposure may occur and the generally low levels of contamination present. There is also limited evidence regarding the impact of PCBs and PAHs however research on other anthozoans has suggested that resistance to this form of contamination would be low (Watson and Tyler-Walters, 2023). Given that seapens are understood to be absent from the study area (**section 2.6.3**), and whilst acknowledging that other burrowing megafauna may still be affected, it is considered that, in this instance, a sensitivity of **medium** would be appropriate (as opposed to the high sensitivity allocated to the biotope by the MarESA).

2.11.4.27 The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

2.11.4.28 The subtidal mud IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

2.11.4.29 The seapens and burrowing megafauna IEF is deemed to be of medium vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium** (reduced from high in the absence of seapens).

West of Copeland MCZ

2.11.4.30 The sensitivity of the West of Copeland MCZ IEFs to disturbance/remobilisation of sediment-bound contaminants are based on assessments made by the MarESA for the constituent biotopes.

2.11.4.31 The disturbance/remobilisation of sediment-bound contaminants has the potential to affect the subtidal coarse sediment IEF, mixed sediment IEF and subtidal sand IEF. The communities in these IEFs are similar to the communities identified for the subtidal environment within the Transmission Assets study area. An assessment of these communities can be found in **paragraphs 2.11.4.3** and **2.11.4.6**.

2.11.4.32 The subtidal coarse sediment IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

2.11.4.33 The subtidal mixed sediment IEF is deemed to be of low vulnerability, recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

2.11.4.34 The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

Intertidal habitat IEFs

2.11.4.35 The sensitivity of the intertidal habitat IEFs to disturbance/remobilisation of sediment-bound contaminants are based on assessments made by the MarESA for the constituent biotopes.

2.11.4.36 The disturbance/remobilisation of sediment-bound contaminants has the potential to affect all the intertidal habitat IEFs. The only representative biotope which was assessed by the MarESA was LS.LSa.MuSa.Lan, which has a low sensitivity to this impact with evidence suggesting the adaptation of various representative polychaete species to metal contamination in the long term (Bryan and Hummerstone, 1973, McQuillan *et al*., 2014). The sensitivity to synthetic compounds is medium, although this assessment focused mainly on pharmaceutical contaminants and pesticides, which are not relevant to the potential impacts arising from the Transmission Assets, and no evidence was found of PCB and PAH contamination causing mortality in *A. marina* (Casado-Martinez *et al*., 2008).

2.11.4.37 The species poor/barren sands IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.4.38 The polychaete/bivalve-dominated muddy sand shores IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.4.39 The *Echinocardium cordatum* and *Ensis* spp. In lower shore and shallow sublittoral slightly muddy fine sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

Magnitude of impact

Subtidal habitat IEFs

2.11.4.40 The MDS for the disturbance/remobilisation of sediment-bound contaminants considers activities to be carried out concurrently. The results of the sediment chemistry analysis for the Transmission Assets are summarised in **section 2.6.3**, with full results presented in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES. In summary, most sites showed contaminant concentrations below the Cefas AL1, and the TEL threshold, with no sites exceeding the Cefas AL2 or PEL thresholds. One station exceeded the Cefas AL1 threshold for nickel, and arsenic exceeded the TEL at 17 stations, mainly around the Morgan Offshore Wind Project: Generation Assets and near to the landfall, but all stations were below Cefas AL1. Sediments at seven sites, mostly within the central section of the survey area, exceeded the Canadian TEL for mercury but all were below the Cefas AL1. Levels of PCBs were detectable at 13 stations but did not exceed any Cefas AL thresholds. The levels of the total ICES-7 PCBs were below the relevant Cefas AL1 threshold at all stations, and total PCBs were below the Cefas AL1 and Cefas AL2 at all stations. Levels of all individual PAHs were below the Cefas AL1 for individual PAHs. For dibenzo[ah]anthracene, which has a lower Cefas AL1, only one station exceeded this threshold. Concentrations of individual PAHs were also well below their respective ERL values. The total PAHs per station were also below the ERL threshold for total PAHs.

2.11.4.41 The results of the sediment chemistry analysis for the Morgan Offshore Wind Project: Generation Assets indicated that levels of arsenic at 17 sample stations marginally exceeded Canadian TEL but were below the Canadian PEL. Concentrations at three of these stations exceeded the Cefas AL1. Concentrations of PAHs in all samples were found to be below the respective TELs/PELs. Levels of PCBs were typically recorded below the limit of detection. In the Morecambe Offshore Windfarm: Generation Assets, no metals exceeded any reference level except three stations which exceeded the Canadian TEL for arsenic. Concentrations of PAHs exceeded OSPAR BAC levels at six of the 20 stations sampled but did not exceed any other reference levels. Further details on sediment contamination are provided in **section 2.6.1** as well as in Volume 2, Annex 2.1: Benthic subtidal and intertidal ecology technical report of the ES.

2.11.4.42 The total area that is likely to be disturbed by construction activities, and therefore the potential volume of material disturbed, resulting in the potential release of sediment bound contaminants is small and localised in extent to the Offshore Order Limits as well as occurring intermittently over the construction phase. The MDS in **Table 2.12** accounts for 1,426,800 m^3 of spoil from sandwave clearance and up to 2,178,000 m^3 of spoil from cable installation activities.

2.11.4.43 Following disturbance during construction activities, the majority of re-suspended sediments are expected to be deposited in the immediate vicinity of the works (described in detail in **section 2.11.2**) dissipating to background levels within 5 km of the source of the disturbance event. The release of contaminants from the small proportion of fine sediments is likely to be rapidly dispersed with the tide and/or currents and therefore increased bioavailability resulting in adverse eco-toxicological effects are not expected.

2.11.4.44 The impact is expected to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

Shell Flat and Lune Deep SAC

2.11.4.45 As discussed in **paragraph 2.11.4.40**, levels of contaminants recorded in sediments during the site-specific surveys were very low. The magnitude of the remobilisation of sediment-bound contaminants impact within the Shell Flat and Lune Deep SAC is likely to be a fraction of what is described for the subtidal habitat IEFs in **paragraph 2.11.4.42**. The Shell Flat and Lune Deep SAC is located 5.72 km from the Offshore Order Limits and increases in SSC due to construction activities will rapidly dissipate to background levels such that any deposition at the SAC would be indistinguishable from background levels. The levels of contamination expected at this site will be minimal due to the low levels of contamination which have been identified by the site specific benthic surveys. Any remobilised sediment-bound contaminants are predicted to have also been subject to significant dispersion and dilution prior to reaching the SAC.

2.11.4.46 The impact is expected to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

Fylde MCZ

2.11.4.47 The magnitude of the impact of disturbance/remobilisation of sediment-bound contaminants in the part of the Transmission Assets which overlaps with the Fylde MCZ is likely to be similar to that predicted for subtidal habitat IEFs in **paragraphs 2.11.4.40** to **2.11.4.43** with low levels, and temporary, increases in SSC increases occurring within the area of the Fylde MCZ which overlaps with the Transmission Assets. The MDS assumes there may be up to 270,000 m^3 of spoil from sandwave clearance within the MCZ and area of up to 2,497,196 m^2 of sediment disturbed within the Fylde MCZ during the construction phase, equating to 0.96% of the total area of the MCZ.

2.11.4.48 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **negligible**.

West of Walney MCZ

2.11.4.49 As discussed in **paragraph 2.11.4.40**, levels of contaminants in sediments were very low. The magnitude of the remobilisation of sediment-bound contaminants impact within the West of Walney MCZ is likely to be a fraction of what is described for the subtidal habitat IEFs in **paragraph 2.11.4.42**. The West of Walney MCZ is located 5.85 km from the Transmission Assets, and any plumes of increased SSC are predicted to dissipate rapidly to background levels within 5 km of the disturbance event, with any sedimentation, should it reach the boundary, being indistinguishable from background levels. Any remobilised sediment-bound contaminants are predicted to have also been subject to significant dispersion and dilution prior to reaching the site.

2.11.4.50 The impact is expected to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

West of Copeland MCZ

2.11.4.51 As discussed in **paragraph 2.11.4.40**, levels of contaminants in sediments were very low. The magnitude of the remobilisation of sediment-bound contaminants impact within the West of Copeland MCZ is likely to be a fraction of what is described for the subtidal habitat IEFs in **paragraph 2.11.4.42**. The West of Copeland MCZ is located 6.32 km from the Offshore Order Limits, and any plumes of increased SSC are predicted to dissipate rapidly to background levels within 5 km of the disturbance event, with any sedimentation, should it reach the boundary, being indistinguishable from background levels. Any remobilised sediment-bound contaminants are predicted to have also been subject to significant dispersion and dilution prior to reaching the site.

2.11.4.52 The impact is expected to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

Intertidal habitat IEFs

2.11.4.53 Open cut trenching and marinesed trenching for the installation of the export cables in the intertidal zone has the potential to result in disturbance/remobilisation of sediment-bound contaminants. As outlined in **Table 2.12**, the MDS assumes that during the construction phase, up to 23,400 m^3 of spoil material may be excavated for all six trenches during export cable installation in the intertidal zone. As in the subtidal, disturbance as a result of construction activities, will result in sediment deposition in the immediate vicinity of the works. The release of contaminants from the small proportion of fine sediments is likely to be rapidly dispersed with the tide and therefore increased bioavailability resulting in adverse eco-toxicological effects are not expected.

2.11.4.54 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **negligible**.

Significance of effect

Subtidal habitat IEFs

2.11.4.55 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the low resemblance stony reef IEF and the brittlestar beds IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been primarily based on the low levels of contamination identified within the Offshore Order Limits.

2.11.4.56 Overall, for the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is high, reduced to **medium** in the absence of seapens, and the magnitude of the impact is **negligible**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been primarily based on the low levels of contamination identified within the Offshore Order Limits.

Shell Flat and Lune Deep SAC

2.11.4.57 Overall for the sandbanks which are slightly covered by sea water IEF and the reef IEF of the Shell Flat and Lune Deep SAC, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been primarily based on the low levels of contamination identified within the site specific survey and the distance between the SAC and the Offshore Order Limits which will allow for dilution.

Fylde MCZ

2.11.4.58 Overall for the subtidal sand IEF and subtidal mud IEFs of the Fylde MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been primarily based on the low levels of contamination identified within the sediments in the Transmission Assets during the site-specific survey.

2.11.4.59 The effects of the disturbance/remobilisation of sediment-bound contaminants on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference: E4).

West of Walney MCZ

2.11.4.60 Overall for the subtidal sand IEF and subtidal mud IEF of the West of Walney MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been primarily based on the low levels of contamination observed in the site specific surveys and the distance between the West of Walney MCZ and the Transmission Assets.

2.11.4.61 Overall for the seapens and burrowing megafauna IEF of the West of Walney MCZ, the sensitivity of the receptor is **medium** (reduced from high in the absence of seapens) and the magnitude of the impact is **negligible**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been primarily based on the low levels of contamination observed in the site specific surveys and the distance between the West of Walney MCZ and the Transmission Assets.

West of Copeland MCZ

2.11.4.62 Overall for the subtidal sand IEF, subtidal coarse sediment IEF and mixed sediment IEF of the West of Copeland MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been primarily based low levels of contamination observed in the site specific surveys and the distance between the West of Copeland MCZ and the Transmission Assets.

Intertidal habitat IEFs

2.11.4.63 Overall, for the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. In lower shore and shallow sublittoral slightly muddy fine sand IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been based on the low levels of sediment disturbance that will occur in the intertidal.

Operation and maintenance phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.4.64 The sensitivities of the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the low resemblance stony reef IEF, the brittlestar beds IEF and the seapens and burrowing megafauna communities IEF to the remobilisation of sediment bound contaminants are as described previous for the construction phase assessment in **paragraphs 2.11.4.3** to **2.11.4.12**.

2.11.4.65 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **low.**

2.11.4.66 The sensitivity of the brittlestar beds IEF is **low**.

2.11.4.67 The sensitivity of the seapens and burrowing megafauna IEF is **high**, reduced to **medium** in the absence of seapens.

2.11.4.68 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **low.**

2.11.4.69 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **low.**

2.11.4.70 The sensitivity of the low resemblance stony reef IEF is **low**.

Shell Flat and Lune Deep SAC

2.11.4.71 The sensitivities of the sandbanks which are slightly covered by sea water all the time IEF and the reef IEF are as described previously for the construction phase assessment in **paragraphs 2.11.4.13** to **2.11.4.17**.

2.11.4.72 The sensitivities of the sandbanks which are slightly covered by sea water IEF and the reefs IEF of Shell Flat and Lune Deep SAC are **low**.

Fylde MCZ

2.11.4.73 The sensitivities of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ are as described previously for the construction phase assessment in **paragraphs 2.11.4.18** to **2.11.4.22**.

2.11.4.74 The sensitivities of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ are **low**.

West of Walney MCZ

2.11.4.75 The sensitivities of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF of the West of Walney MCZ are as described previously for the construction phase assessment in **paragraphs 2.11.4.23** to **2.11.4.29**.

2.11.4.76 The sensitivities of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ are **low**.

2.11.4.77 The seapens and burrowing megafauna IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium** (reduced from high in the absence of seapens).

West of Copeland MCZ

2.11.4.78 The sensitivities of the subtidal coarse sediment IEF, the subtidal mixed sediment IEF and the subtidal sand IEF are as described previously for the construction phase assessment in **paragraphs 2.11.4.30** to **2.11.4.34**.

2.11.4.79 The sensitivities of the subtidal coarse sediment IEF, the subtidal mixed sediment IEF and the subtidal sand IEF of the West of Copeland MCZ are **low**.

Intertidal habitat IEFs

2.11.4.80 The sensitivities of the species poor/barren sands IEF, polychaete/bivalve-dominated muddy sand shores IEF and *Echinocardium cordatum* and *Ensis* spp. In lower shore and shallow sublittoral slightly muddy fine sand IEF are as described previously for the construction phase assessment in **paragraphs 2.11.4.35** to **2.11.4.39**.

2.11.4.81 The sensitivity of the species poor/barren sands IEF sensitivity is **low**.

2.11.4.82 The sensitivity of the Polychaete/bivalve-dominated muddy sand shores IEF is **low**.

2.11.4.83 The sensitivity of the *Echinocardium cordatum* and *Ensis* spp. In lower shore and shallow sublittoral slightly muddy fine sand IEF is **low**.

Magnitude of impact

Subtidal habitat IEFs

2.11.4.84 In the operation and maintenance phase the disturbance/remobilisation of sediment-bound contaminants could result from the repair and reburial of export cables. These activities will result in the remobilisation of sediment but on a much reduced scale compared to the construction phase. Whilst receptors may be impacted directly, the activities will occur intermittently over the 35-year lifetime. Any plumes of increased SSC are predicted to dissipate rapidly to background levels within 5 km of the disturbance event, with any sedimentation, should it reach the boundary, being indistinguishable from background levels. Any remobilised sediment-bound contaminants are also predicted to be subject to significant dispersion and dilution upon release, as outlined in Volume 2, Chapter 1: Physical processes of the ES and as noted in **Table 2.12**.

2.11.4.85 The impact is expected to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

Shell Flat and Lune Deep SAC

2.11.4.86 As discussed in **paragraph 2.11.4.40**, levels of contaminants recorded in sediments during the site-specific surveys were very low. The magnitude of the remobilisation of sediment-bound contaminants impact within the Shell Flat and Lune Deep SAC is likely to be a fraction of what is described for the subtidal habitat IEFs in **paragraph 2.11.4.84**. The Shell Flat and Lune Deep SAC is located 5.72 km from the Transmission Assets and has the potential to be impacted by disturbed sediment, but only at very low levels which are not predicted to be distinguishable from background levels. Sediment disturbance events, and any remobilisation of contaminants, would be highly intermittent and occurring over short periods. The levels of contamination expected at this site will be minimal due to the low levels of contamination which have been identified by the site specific benthic surveys. Any remobilised sediment-bound contaminants from maintenance activities is predicted to have also been subject to significant dispersion and dilution prior to reaching the SAC.

2.11.4.87 The impact is expected to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

Fylde MCZ

2.11.4.88 The impact of disturbance/remobilisation of sediment-bound contaminants in the part of the Transmission Assets which overlaps with the Fylde MCZ are likely to be similar to that predicted for subtidal habitat IEFs in **paragraph 2.11.4.84**. The MDS associated with this impact is for up to 833,896 m^2 of temporary seabed disturbance as a result of export cable maintenance over the lifetime of the cables within the Fylde MCZ. This equates to 0.32% of the total area of the MCZ.

2.11.4.89 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **negligible**.

West of Walney MCZ

2.11.4.90 As discussed in **paragraph 2.11.4.40**, levels of contaminants in sediments were very low. The magnitude of the remobilisation of sediment-bound contaminants impact within the West of Walney MCZ is likely to be a fraction of what is described for the subtidal habitat IEFs in **paragraph 2.11.4.84**. The West of Walney MCZ is located 5.85 km from the Transmission Assets, and whilst remobilised and redistributed material may reach the south edge of the West of Walney MCZ it would be in depths indistinguishable from background levels. Any remobilised sediment-bound contaminants as a result of maintenance activities is predicted to have also been subject to significant dispersion and dilution prior to reaching the site.

2.11.4.91 The impact is expected to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

West of Copeland MCZ

2.11.4.92 As discussed in **paragraph 2.11.4.40**, levels of contaminants in sediments were very low. The magnitude of the remobilisation of sediment-bound contaminants impact within the West of Copeland MCZ is likely to be a fraction of what is described for the subtidal habitat IEFs in **paragraph 2.11.4.84**. The West of Copeland MCZ is located 6.32 km from the Offshore Order Limits, and whilst remobilised and redistributed material may reach the south edge of the West of Copeland MCZ it would be in depths indistinguishable from background levels. Any remobilised sediment-bound contaminants are predicted to have also been subject to significant dispersion and dilution prior to reaching the site.

2.11.4.93 The impact is expected to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

Intertidal habitat IEFs

2.11.4.94 In the operation and maintenance phase the disturbance/remobilisation of sediment-bound contaminants could result from activities such as repair and reburial of export cables crossing the intertidal zone, which could cause a degree of sediment disturbance likely to be less than the construction phase. This impact is expected to be intermittent and of a small scale.

2.11.4.95 The impact is expected to be of local spatial extent and short term duration. The magnitude is therefore **negligible**.

Significance of effect

Subtidal habitat IEFs

2.11.4.96 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the low resemblance stony reef IEF and the brittlestar beds IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been primarily based on the low levels of contamination, the intermittent nature of this impact during the operation and maintenance phase and small area which will be disturbed during each maintenance event.

2.11.4.97 Overall, for the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is high, reduced to **medium** in the absence of seapens, and the magnitude of the impact is **negligible**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been primarily based on the low levels of contamination identified within the Offshore Order Limits, and the intermittent nature of the operation and maintenance activities.

Shell Flat and Lune Deep SAC

2.11.4.98 Overall for the sandbanks which are slightly covered by sea water IEF and reef IEF of the Shell Flat and Lune Deep SAC, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been primarily based on the low levels of contamination, the intermittent nature of this impact during the operation and maintenance phase and small area which will be disturbed during each maintenance event.

Fylde MCZ

2.11.4.99 Overall for the subtidal sand IEF and subtidal mud IEF of the Fylde MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact both in term of area affected, the levels of contamination identified within this site and the intermittent nature of the maintenance events resulting in the potential remobilisation of contaminants.

2.11.4.100 The effects of the disturbance/remobilisation of sediment-bound contaminants on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference: E4).

West of Walney MCZ

2.11.4.101 Overall for the subtidal sand IEF and subtidal mud IEF of the West of Walney MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact both in term of area affected, the levels of contamination identified within this site and the intermittent nature of the maintenance events resulting in the potential remobilisation of contaminants.

2.11.4.102 Overall for the seapens and burrowing megafauna IEF of the West of Walney MCZ, the sensitivity of the receptor is **medium** (reduced from high in the absence of seapens) and the magnitude of the impact is **negligible**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact both in term of area affected, the levels of contamination identified within this site and the intermittent nature of the maintenance events resulting in the potential remobilisation of contaminants.

West of Copeland MCZ

2.11.4.103 Overall for the subtidal sand IEF, subtidal coarse sediment IEF and the mixed sediment IEF of the West of Copeland MCZ, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact both in term of area affected, the levels of contamination identified within this site and the intermittent nature of the maintenance events resulting in the potential remobilisation of contaminants.

Intertidal habitat IEFs

2.11.4.104 Overall, for the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. In lower shore and shallow sublittoral slightly muddy fine sand IEF the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been primarily based on the intermittent nature of this impact during the operation and maintenance phase and small area which will be disturbed during each maintenance event.

Decommissioning phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.4.105 The sensitivities of the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the low resemblance stony reef IEF, the brittlestar beds IEF and the seapens and burrowing megafauna communities IEF are as described previously for the construction phase assessment in **paragraphs 2.11.4.3** to **2.11.4.12**.

2.11.4.106 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **low**.

2.11.4.107 The sensitivity of the brittlestar beds IEF is **low**.

2.11.4.108 The sensitivity of the seapens and burrowing megafauna IEF is **high**, reduced to **medium** in the absence of seapens.

2.11.4.109 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **low**.

2.11.4.110 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **low**.

2.11.4.111 The sensitivity of the low resemblance stony reef IEF is **low**.

Shell Flat and Lune Deep SAC

2.11.4.112 The sensitivities of the sandbanks which are slightly covered by sea water all the time IEF and the reef IEFs are as described previously for the construction phase assessment in **paragraphs 2.11.4.13** to **2.11.4.17**.

2.11.4.113 The sensitivities of the sandbanks which are slightly covered by sea water IEF and the reef IEF of the Shell Flat and Lune Deep SAC are **low**.

Fylde MCZ

2.11.4.114 The sensitivities of the subtidal sand IEF and the subtidal mud IEFs is as described previously for the construction phase assessment in **paragraphs 2.11.4.18** to **2.11.4.22**.

2.11.4.115 The sensitivities of the subtidal sand IEF and subtidal mud IEF of the Fylde MCZ are **low**.

West of Walney MCZ

2.11.4.116 The sensitivities of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF are as described previously for the construction phase assessment in **paragraphs 2.11.4.23** to **2.11.4.29**.

2.11.4.117 The sensitivities of the subtidal sand IEF and the subtidal mud IEF of the West of Walney MCZ are **low**.

2.11.4.118 The seapens and burrowing megafauna IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium** (reduced from high in the absence of seapens).

West of Copeland MCZ

2.11.4.119 The sensitivities of the subtidal coarse sediment IEF, the subtidal mixed sediment IEF and the subtidal sand IEF are as described previously for the construction phase assessment in **paragraphs 2.11.4.30** to **2.11.4.34**.

2.11.4.120 The sensitivities of the subtidal coarse sediment IEF, the subtidal mixed sediment IEF and the subtidal sand IEF of the West of Copeland MCZ are **low**.

Intertidal habitat IEFs

2.11.4.121 The sensitivities of the species poor/barren sands IEF, polychaete/bivalve-dominated muddy sand shores IEF and *Echinocardium cordatum* and *Ensis* spp. In lower shore and shallow sublittoral slightly muddy fine sand IEF are as described previously for the construction phase assessment in **paragraphs 2.11.4.35** to **2.11.4.39**.

2.11.4.122 The sensitivity of the species poor/barren sands IEF is **low**.

2.11.4.123 The sensitivity of the polychaete/bivalve-dominated muddy sand shores IEF is **low**.

2.11.4.124 The sensitivity of the *Echinocardium cordatum* and *Ensis* spp. In lower shore and shallow sublittoral slightly muddy fine sand IEF is **low**.

Magnitude of impact

Subtidal habitat IEFs

2.11.4.125 The disturbance/remobilisation of sediment-bound contaminants may occur intermittently during the decommissioning phase as a result of sediment disturbance arising from the removal of export cables. As it is reasonable to assume that the metals, PCBs and PAHs identified in the baseline characterisation survey would continue to be present in the sediments of the Transmission Assets during decommissioning as during construction, the magnitude of this impact in terms of levels of contamination will be similar to that presented in **paragraphs 2.11.4.40** to **2.11.4.44** for the construction phase.

2.11.4.126 The extent to sediment disturbance predicted during the decommissioning phase is anticipated to be much less than described for the construction phase. However, as described for the construction phase, the majority of sediments resuspended during decommissioning activities are expected to be deposited in the immediate vicinity of the works. The release of contaminants from the small proportion of fine sediments is likely to be rapidly dispersed with the tide and/or currents and therefore increased bioavailability resulting in adverse eco-toxicological effects are not expected.

2.11.4.127 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **negligible**.

Shell Flat and Lune Deep SAC

2.11.4.128 As discussed in **paragraph 2.11.4.40**, levels of contaminants recorded in sediments during the site-specific surveys were very low. The magnitude of the remobilisation of sediment-bound contaminants impact within the Shell Flat and Lune Deep SAC is likely to be a fraction of what is described for the subtidal habitat IEFs in **paragraphs 2.11.4.125** and **2.11.4.126** due to the reduction in the number of required sandwave clearance and seabed preparation activities during this phase, as noted in **section 2.11.3**. The Shell Flat and Lune Deep SAC is located 5.72 km from the Offshore Order Limits. Any remobilised sediment-bound contaminants are predicted to have also been subject to significant dispersion and dilution prior to reaching the SAC.

2.11.4.129 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **negligible**.

Fylde MCZ

2.11.4.130 The impact of disturbance/remobilisation of sediment-bound contaminants in the part of the Transmission Assets which overlaps with the Fylde MCZ are likely to be similar to that predicted for subtidal habitat IEFs in **paragraph 2.11.4.125**. The MDS associated with the decommissioning phase may be up to the values calculated for the construction phase (**paragraph 2.11.4.47**); however, it is likely to be less than this as decommissioning won't include activities such as sandwave clearance for site preparation which contributed heavily to disturbance in the construction phase.

2.11.4.131 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **negligible**.

West of Walney MCZ

2.11.4.132 As discussed in **paragraph 2.11.4.40**, levels of contaminants in sediments were very low. The magnitude of the remobilisation of sediment-bound contaminants impact within the West of Walney MCZ is likely to be a fraction of what is described for the subtidal habitat IEFs in **paragraphs 2.11.4.125** and **2.11.4.126**. The West of Walney MCZ is located 5.85 km from the Offshore Order Limits and plumes related to the removal of cable protection are not predicted to extend to this designated site, with a maximum predicted sediment plume range of 5 km. Any remobilised sediment-bound contaminants are predicted to have also been subject to significant dispersion and dilution prior to reaching the site.

2.11.4.133 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **negligible**.

West of Copeland MCZ

2.11.4.134 As discussed in **paragraph 2.11.4.40**, levels of contaminants in sediments were very low. The magnitude of the remobilisation of sediment-bound contaminants impact within the West of Copeland MCZ is likely to be a fraction of what is described for the subtidal habitat IEFs in **paragraphs 2.11.4.125** and **2.11.4.126**. The West of Copeland MCZ is located 6.32 km from the Transmission Assets and plumes related to the removal of cable protection are not predicted to extend to this designated site, with a maximum predicted sediment plume range of 5 km, and any sediment at this distance being indistinguishable from background levels. Any remobilised sediment-bound contaminants are predicted to have also been subject to significant dispersion and dilution prior to reaching the site.

2.11.4.135 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is therefore **negligible**.

Intertidal habitat IEFs

2.11.4.136 The MDS assumes that all export cables may be removed at the landfall. The magnitude of this impact is predicted to be similar to that described in **paragraphs 2.11.4.53** and **2.11.4.54** for the construction phase as the activities will be of a similar nature.

2.11.4.137 The impact is predicted to be of local spatial extent and short-term duration. The magnitude is there **negligible**.

Significance of effect

Subtidal habitat IEFs

2.11.4.138 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the low resemblance stony reef IEF and the brittlestar beds IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been primarily based on the low levels of contamination, the short term and intermittent nature of this impact during the decommissioning phase and small area which will be disturbed.

2.11.4.139 Overall, for the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is high, reduced to **medium** in the absence of seapens, and the magnitude of the impact is **negligible**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been primarily based on the low levels of contamination identified within the Offshore Order Limits.

Shell Flat and Lune Deep SAC

2.11.4.140 Overall for the sandbanks which are slightly covered by sea water IEF and the reef IEF of the Shell Flat and Lune Deep SAC, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been primarily based on the low levels of contamination identified within the site specific survey and the distance between the SAC and decommissioning locations which will allow for dilution.

Fylde MCZ

2.11.4.141 Overall for the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact both in term of area affected and the levels of contamination identified within this site.

2.11.4.142 The effects of the disturbance/remobilisation of sediment-bound contaminants on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference: E4).

West of Walney MCZ

2.11.4.143 Overall for the subtidal sand IEF and the subtidal mud of the West of Walney MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact both in term of area affected and the levels of contamination identified within this site.

2.11.4.144 Overall for the seapens and burrowing megafauna IEFs of the West of Walney MCZ, the sensitivity of the receptor is **medium** (reduced from high in the absence of seapens) and the magnitude of the impact is **negligible**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact both in term of area affected and the levels of contamination identified within this site.

West of Copeland MCZ

2.11.4.145 Overall for the subtidal sand IEF, the subtidal coarse sediment IEF and mixed sediment IEF of the West of Copeland MCZ, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact both in term of area affected and the levels of contamination identified within this site.

Intertidal habitat IEFs

2.11.4.146 Overall, for the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. In lower shore and shallow sublittoral slightly muddy fine sand IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion has been primarily based on the short term and intermittent nature of this impact during the decommissioning phase and small area which will be disturbed.

2.11.5 Long term habitat loss

2.11.5.1 Long term subtidal habitat loss within the study area will begin during the construction phase as infrastructure is gradually installed and will continue during the operation and maintenance phase when infrastructure is operational, and during the decommissioning phase (**Table 2.12**). Long term habitat loss will occur directly under all cable protection (including at cable crossings) and will lead to habitat alteration and a physical change to another seabed type under the cable protection material. Magnitude has been considered for the construction and operation and maintenance phases combined as the structures will be placed during construction and remain throughout operation and maintenance phase. The potential impact of habitat loss occurring during the decommissioning phase has also been considered as the MDS assumes that scour and cable protection will be left *in situ* following decommissioning.

2.11.5.2 The relevant MarESA pressure and its benchmark which has been used to inform this impact assessment is:

- physical change (to another seabed type): the benchmark for which is change in sediment type by one Folk class (based on UK SeaMap simplified classification (Long, 2006)) and change from sedimentary or soft rock substrata to hard rock or artificial substrata or vice-versa.

2.11.5.3 This pressure is relevant to the installation of the cable protection which will replace the sedimentary seabed with hard structures for the duration of the operation and maintenance phase (35 years).

Construction and operation and maintenance phases

Sensitivity of receptor

Subtidal habitat IEFs

2.11.5.4 The subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal muddy sands with relatively species poor benthic communities IEF, subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, brittlestar bed IEF and seapens and burrowing megafauna communities IEF all have a high sensitivity to the defined MarESA pressure. This is because the installation of hard surfaces would change the sedimentary nature of the biotopes and would lead to the development of new communities on the hard substrate which would require reclassification (JNCC, 2022). It is likely that infrastructure such as cable protection will largely occur on sedimentary habitats, and this introduced hard substrate could be colonised by similar communities which have been identified in areas of cobbles/stony sediment (an assessment of the impacts from the introduction of artificial structures is presented in **section 2.11.6**).

2.11.5.5 The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.5.6 The brittlestar bed IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.5.7 The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.5.8 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.5.9 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

Fylde MCZ

2.11.5.10 The MarESA determines the biotopes associated with the subtidal sand IEF and subtidal mud IEF of the Fylde MCZ have a high sensitivity to the ‘physical change to another substratum’ pressure associated with long term subtidal habitat loss. The sensitivity is considered high as the installation of hard structure would lead to a change in substrate which would no longer represent the biotopes associated with these IEFs.

2.11.5.11 The subtidal sand IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high**.

2.11.5.12 The subtidal mud IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high**.

Magnitude of impact

Subtidal habitat IEFs

2.11.5.13 The presence of the Transmission Assets infrastructure within the study area will result in long term habitat loss. The MDS outlined in **Table 2.12** is for up to 576,500 m^2 of long term habitat loss due to the installation of cable protection and protection for cable crossings. This equates to 0.093% of the Offshore Order Limits and 0.003% of the study area. The MDS for long term habitat loss is for the sequential construction scenario as this equates to the greatest time over which long term habitat loss may occur. Although it should be noted that the total extent of long term habitat loss is the same for both the concurrent and sequential scenarios.

2.11.5.14 Long term subtidal habitat loss potential impacts will occur during the construction phase, will be continuous throughout the 35 year operation and maintenance phase and will affect receptors directly. During and after the operation and maintenance phase it is likely that the cable protection will become colonised by hard structure adapted communities similar to those which occur on the natural hard substrates (further details are provided in **section 2.11.6**). Therefore, it may be accurate to refer to the permanent placement of the Transmission Assets infrastructure (i.e. cable protection) as habitat alternation rather than loss, as these artificial habitats may be left *in situ*.

2.11.5.15 The impact is predicted to be of local spatial extent and long term duration. The magnitude is therefore **low**.

Fylde MCZ

2.11.5.16 As the Fylde MCZ overlaps spatially with the Transmission Assets there may be long term habitat loss within the MCZ as a result of cable protection for ground conditions or for the single cable crossing (for all four of the Morgan export cables). The MDS for the Fylde MCZ assumes that up to 3% of the Morecambe and 3% of the Morgan export cables within the Fylde MCZ may require cable protection with a width of 10 m. The MDS also assumes a single cable crossing will be required for the Morgan export cables (one crossing for all four cables) but that no crossings will be required for the Morecambe export cables. The installation of infrastructure resulting in long term habitat loss will commence during the construction phase and will persist for the full 35 year operation and maintenance phase. The MDS is for up to 30,400 m^2 of long term habitat loss within the Fylde MCZ, which equates to 0.012% of the total area of the MCZ (reduced from 159,580 m^2 in the PEIR, a reduction of 80.95%). The MDS for each of the features assumes that the habitat loss associated with any cable protection and the cable crossing could occur entirely within the subtidal sand IEF or the subtidal mud IEF. The MDS is for long term habitat loss of up to 30,400 m^2 of the subtidal mud IEF (equating to 0.07% of the total area of the subtidal mud feature in the MCZ) and up to 30,400 m^2 of the subtidal sand IEF (equating to 0.014% of the total area of the subtidal sand feature in the MCZ).

2.11.5.17 The impact is predicted to be of local spatial extent and long-term duration for both the features of the Fylde MCZ. The magnitude is therefore **low**.

Intertidal habitat IEFs

2.11.5.18 All permanent infrastructure located between MLWS and MHWS will be buried to a target depth of 3 m as per CoT114, **Table 2.11**. There will, therefore, be no long-term loss of intertidal habitats or IEFs as a result of cable protection. This impact is therefore not considered further.

Significance of effect

Subtidal habitat IEFs

2.11.5.19 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and the seapens and burrowing communities IEF, the sensitivity of the receptor is **high** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This has been concluded on basis of the small proportion (0.093%) of the Offshore Order Limits that will be affected which is unlikely to compromise the integrity of these habitats such that they would not be able to support their characterising communities or perform their ecosystem function.

Fylde MCZ

2.11.5.20 Overall for the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ, the sensitivity of the receptor is **high** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact in terms of area and proportion of the MCZ affected.

2.11.5.21 The effects of long term habitat loss on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference: E4).

Decommissioning phase

2.11.5.22 The potential for cable protection to remain on the seabed following the decommissioning process and to remain in perpetuity, has been assessed in this section, as permanent habitat alteration on the basis that this habitat will be recolonised over time.

2.11.5.23 As detailed in commitments CoT108 and CoT109 (**Table 2.11**), all external cable protection used within the Fylde MCZ will be designed to be removable on decommissioning with the requirement for removal agreed with stakeholders and regulators at the time of decommissioning. Therefore habitat loss/alteration within the Fylde MCZ will not persist beyond the decommissioning phase and so has not been assessed further.

Sensitivity of receptor

Subtidal habitat IEFs

2.11.5.24 The sensitivity of the subtidal sedimentary IEFs is as described previously for the construction and operation and maintenance phases assessment in **paragraph 2.11.5.4** to **2.11.5.9**.

2.11.5.25 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **high**.

2.11.5.26 The brittlestar beds IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.5.27 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **high**.

2.11.5.28 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **high**.

2.11.5.29 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

Magnitude of impact

Subtidal habitat IEFs

2.11.5.30 The presence of the Transmission Assets infrastructure which may remain post-decommissioning (i.e. cable protection) will result in permanent habitat loss or permanent habitat alteration. The MDS in **Table 2.12** accounts for up to 576,500 m^2 of permanent habitat loss/alteration due to cable protection being left *in situ*. This accounts for a very small proportion (0.093%) of the Offshore Order Limits and of the study area (0.003%).

2.11.5.31 Some areas of cable protection may gradually become buried by sediment, which may facilitate some recolonisation of sedimentary species, into these areas. In other areas, previously soft sediments will not return to soft sediments and therefore there is no potential for recovery of sedimentary communities.

2.11.5.32 Any cable protection remaining after decommissioning will provide an ongoing substrate for colonisation by benthic communities although the communities that develop and persist are likely to be different from those originally found in the previously soft sediment environment. Changes in community composition may also occur in the benthic communities present within the soft-sediment environments immediately adjacent to the cable protection. This may result from, for example, detachment of fouling species from the structures, sediment enrichment and export of organic matter to the seabed by fouling organisms (Coolen *et al*., 2022).

2.11.5.33 The impact is predicted to be of local spatial extent and long-term duration. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

2.11.5.34 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is **high** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This is concluded on the basis that only a small proportion of the total area of the IEFs in the Offshore Order Limits will be affected which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function.

2.11.6 Introduction of artificial structures

2.11.6.1 The introduction of infrastructure associated with the Transmission Assets may result in the colonisation of these artificial structures (i.e. cable protection and cable crossing protection). The introduction of artificial structures will commence during the construction phase as infrastructure is gradually installed and will continue during the operation and maintenance phase when infrastructure is operational (**Table 2.12**). The assessment of this impact has therefore been considered for the construction and operation and maintenance phases combined.

2.11.6.2 The environmental pressures associated with this potential impact are the same as those associated with long term subtidal habitat loss because the physical change (to another substratum type) pressure involves the permanent loss of one marine habitat type but has an equal creation of a different marine habitat type component such as the installation of cable protection. The pressure is described for the MarESA in **paragraph 2.11.5.2**.

Construction and operation and maintenance phases

Sensitivity of receptor

Subtidal habitat IEFs

2.11.6.3 The sensitivity of the subtidal habitat IEFs within the Transmission Assets to physical change (to another seabed type) is as described previously for the long term subtidal habitat loss assessment in **section 2.11.5**. The introduction and colonisation of artificial structures will affect all subtidal habitat IEFs, with the potential for indirect adverse effects on surrounding sedimentary communities and habitats due to increased predation on and competition with the existing soft sediment species. These effects are difficult to predict, especially as monitoring to date has focused on the colonisation of species close to introduced structures, rather than broad scale studies.

2.11.6.4 Placing the hard structures on the seabed not only creates new habitat but also modifies or removes existing habitat (as assessed in **section 2.11.5**). Often it replaces an essentially two-dimensional sedimentary seabed with a complex 3-D structure, thereby increasing surface area, surface complexity and number of niches (Dannheim *et al*., 2019). The development of such surfaces and their role in connectivity of populations depends on the right type of surface being created, in the right location and at the right distance from the source populations. The surface may only be suitable for colonisation after being suitably weathered resulting in the loss of any surface contaminants, the production of a biofilm and the sequence of development of the community after settlement.

2.11.6.5 This may produce some potentially beneficial effects for the wider ecosystem. For example, the likely increase in biodiversity and individual abundance of reef species and total number of species over time, has been observed at the monopile foundations installed at Lysekil research site (a test site for offshore wind-based research, north of Gothenburg, Sweden) (Bender *et al.*, 2020). This is supported by recent research by Lefaible *et al.* (2023) which found that species richness and abundance were both elevated in the immediate vicinity of foundations (37 m from the foundations), but the effect was absent at a distance (350-500 m from the foundations). Additionally, the structural complexity of the substrate may provide refuge as well as increasing feeding opportunities for larger and more mobile species. The presence of mobile benthic organisms is considered to be dependent on sufficient food sources, cover of epibenthic communities and appropriate habitat with shelter opportunities to hide from predators (Langhamer and Wilhelmsson, 2009). This effect has also been observed at jacket foundations; a study by Lefaible *et al*. (2019) identified that jacket foundations had higher densities and diversity (species richness) of species in closer vicinity of the wind turbines compared to a control and a monopile foundation. Mavraki *et al*. (2020) studied of gravity-based foundations in the Belgian part of the North Sea and found that higher food web complexity was associated with zones where high accumulation of organic material such as soft substrate or scour protection, suggesting potential reef effect benefits from the presence of the hard structures. The cables themselves and associated protection have the potential to act directly as areas for colonising hard substrate species (Sherwood *et al*., 2016), with the complexity of the protection structure being an important factor in levels of colonisation and the size of the artificial reef effect (Langhamer, 2012).

2.11.6.6 Studies have shown that the installation and operation of offshore wind farms have no significant impact on the wider soft sediment environments beyond the immediate impact of the loss of habitat. De Backer *et al*. (2021) found that eight to nine years after the installation of C-power and Belwind offshore wind farms (offshore Belgium) that the soft sediment epibenthos underwent no drastic changes; and the species originally inhabiting the sandy sediments were still present and remained dominant in both wind farms. The most recent benthic post-construction monitoring data of wind turbine foundations from Beatrice offshore wind farm (APEM, 2021) found foundation colonisation of wind turbines had little influence on the sedimentary habitat below. Furthermore a study by Li *et al*. (2023) concluded there are no net adverse impacts during offshore wind farm operation and maintenance phases (assuming 25-year operation) on benthic communities inhabiting the baseline sandy environment within many offshore wind farms.

2.11.6.7 However, for the areas directly impacted by the introduction of hard structures, the local baseline will change, with little to no resistance to this impact and low capacity for recovery.

2.11.6.8 The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.6.9 The brittlestar beds IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.6.10 The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.6.11 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.6.12 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

Fylde MCZ

2.11.6.13 The sensitivity of the IEFs within Fylde MCZ to physical change (to another substratum) is as described previously for the long term subtidal habitat loss assessment in **paragraphs 2.11.5.10** to **2.11.5.12**.

2.11.6.14 The subtidal sand IEF and subtidal mud IEF of the Fylde MCZ could be potentially impacted differently by the introduction of hard substrate compared to the sedimentary communities. Communities found on hard substrate may be able to make greater use of the hard substrates and current research suggests it could result in the spread of such communities.

2.11.6.15 The biotopes which characterise the subtidal sands IEF (i.e. SS.SCS.ICS.MoeVen, SS.SCS.ICS.Glap and SS.SSa.CMuSa.AalbNuc) and subtidal mud IEF (i.e. SS.SMu.CSaMu.AfilKurAnit, SS.SSa.CMuSa, SS.SSa.IMuSa.EcorEns and SS.SMu.CSaMu.LkorPpel) are sand and mud based communities and the introduction of new hard substrate will represent a shift from the baseline conditions from soft substrate areas to hard substrate in the areas where infrastructure is present. The effect of the introduction of these artificial structures has been assessed in **paragraphs 2.11.6.3** to **2.11.6.7**.

2.11.6.16 In conclusion the installation of cable protection will result in the loss of some sedimentary habitat directly below it however the remaining sedimentary habitat will not be degraded and will largely remain unchanged as a result of the introduction of artificial structures.

2.11.6.17 The subtidal sand IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high**.

2.11.6.18 The subtidal mud IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high**.

Magnitude of impact

Subtidal habitat IEFs

2.11.6.19 The MDS in **Table 2.12** accounts for the introduction of up to 576,500 m^2 of artificial structures due to the installation of cable protection associated with offshore export cables. This equates to 0.093% of the Offshore Order Limits and 0.003% of the study area. It is expected that the cable protection will be colonised by epifaunal species already occurring in the study area (e.g. tunicates, bryozoans, mussels and barnacles which are typical of temperate seas). The MDS for introduction of artificial structures in the construction phase is for the sequential construction scenario as this equates to the greatest time over which colonisation of artificial structures may occur. Although it should be noted that the total extent of the artificial structures introduced is the same for both the concurrent and sequential scenarios.

2.11.6.20 The impact is predicted to be of local spatial extent and long term duration. The magnitude is therefore **low**.

Fylde MCZ

2.11.6.21 The MDS for the Fylde MCZ outlined in **Table 2.12**, assumes that up to 3% of the Morecambe export cables and 3% of the Morgan export cables within the Fylde MCZ may require cable protection with a width of 10 m. A single cable crossing will also be required for the Morgan export cables (single crossing for all four cables) but no crossings are required for the Morecambe export cables. This may result in the introduction of up to 30,400 m^2 of artificial structures which will be available for colonisation within the MCZ, which represents 0.0012% of the total area of the MCZ. This could represent the introduction of up to 30,400 m^2 of artificial structures to the sand feature (0.01% of the overall sand feature within the MCZ), and up to 30,400 m^2 (0.07%) of the mud feature within the MCZ.

2.11.6.22 The impact is predicted to be of local spatial extent and long-term duration for both the features of the Fylde MCZ. The magnitude is therefore **low**.

Intertidal habitat IEFs

2.11.6.23 The MDS for cable installation at the landfall is open cut and marinesed trenching (see **Table 2.12**) which will result in all export cables being buried in the intertidal zone. All permanent infrastructure located between MLWS and MHWS will be buried to a target depth of 3 m as per CoT114, **Table 2.11**), so there would be no artificial structures available for colonisation. This impact is therefore not considered further for intertidal habitats.

Significance of effect

Subtidal habitat IEFs

2.11.6.24 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is **high** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been reached based on the localised nature of this impact which will be largely restricted to the cable protection and the immediate surrounding area.

Fylde MCZ

2.11.6.25 Overall for the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ, the sensitivity of the receptor is **high** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact in terms of area affected.

2.11.6.26 The effects of the introduction of artificial structures on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference: E4).

Decommissioning phase

2.11.6.27 The presence of any Transmission Assets infrastructure which is left *in situ* post-decommissioning will result in permanent presence of artificial structures. As detailed in commitments CoT108 and CoT109 (**Table 2.11**), all external cable protection used within the Fylde MCZ will be designed to be removable on decommissioning with the requirement for removal agreed with stakeholders and regulators at the time of decommissioning. Therefore the introduction of artificial structures within the Fylde MCZ will not persist beyond the decommissioning phase and so has not been assessed further.

Sensitivity of receptor

Subtidal habitat IEFs

2.11.6.28 The sensitivities of the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and the seapens and burrowing megafauna communities IEF are as described previously for the construction phase assessment in **paragraphs 2.11.6.3** to **2.11.6.12**.

2.11.6.29 The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.6.30 The brittlestar beds IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.6.31 The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.6.32 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.6.33 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

Fylde MCZ

2.11.6.34 The sensitivities of the IEFs within Fylde MCZ are as described previously for the construction phase, as outlined in **paragraphs 2.11.6.13** to **2.11.6.18**.

2.11.6.35 The subtidal sand IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high**.

2.11.6.36 The subtidal mud IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high**.

Magnitude of impact

Subtidal habitat IEFs

2.11.6.37 The MDS in **Table 2.12** is for up to 576,500 m^2 of permanent artificial structures due to the cable protection and protection for cable crossings being left *in situ* after decommissioning. This equates to 0.093% of the Offshore Order Limits and 0.003% of the study area. In areas of previously soft sediments where the cable protection is left *in situ* on the seabed, the substrate will not return to soft sediments and will be permanently altered by the presence of cable protection, as these artificial structures will provide a substrate for benthic communities although they are likely to be different from those originally found at these sites.

2.11.6.38 The impact on the subtidal habitat IEFs is predicted to be of local spatial extent, long term duration, continuous and irreversible. The magnitude is therefore **low**.

Fylde MCZ

2.11.6.39 The MDS outlined in **Table 2.12** for the Fylde MCZ assumes that up to 3% of the Morecambe export cables and 3% of the Morgan export cables within the Fylde MCZ may require cable protection with a width of 10 m. A single cable crossing will also be required for the Morgan export cables (single crossing for all four cables) but no crossings are required for the Morecambe export cables. This may result in the introduction of up to 30,400 m^2 of artificial structures which will be available for colonisation within the MCZ, which represents 0.012% of the total area of the MCZ. This will represent the introduction of up to 30,400 m^2 of artificial structures to the sand feature (0.01% of the overall sand feature within the MCZ), and up to 30,400 m^2 (0.07%) of the mud feature within the MCZ.

2.11.6.40 The impact is predicted to be of local spatial extent and long-term duration for both the features of the Fylde MCZ. The magnitude is therefore **low**.

Significance of effect

Subtidal habitat IEFs

2.11.6.41 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is **high** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been reached based on the localised nature of this impact which will be largely restricted to the cable protection and the immediate surrounding area.

Fylde MCZ

2.11.6.42 Overall for the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ, the sensitivity of the receptor is **high** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact in terms of area affected.

2.11.6.43 The effects of the introduction of artificial structures on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference: E4).

2.11.7 Increased risk of introduction and spread of invasive non-native species

2.11.7.1 The increased risk of introduction and spread of INNS during the construction, operation and maintenance, and decommissioning phases has been considered in this assessment.

2.11.7.2 The benchmark for the relevant MarESA pressure which has been used to inform this impact assessment is:

- introduction or spread of INNS: The benchmark for which is the introduction of one or more INNS.

2.11.7.3 This pressure is relevant to the introduction of artificial substrates into an established community.

Construction phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.7.4 The sensitivity of the subtidal habitat IEFs to increased risk of introduction and spread of INNS are presented in **Table 2.20**. These sensitivities are based on assessments made by the MarESA for the constituent biotopes.

2.11.7.5 The subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF constituent biotopes have been assessed as all having a high sensitivity to this impact, with evidence suggesting that although sedimentary environments tend to be difficult to colonise (Tillin, 2023a), the introduction of artificial hard surfaces will increase the possibility of INNS colonisation.

2.11.7.6 The slipper limpet *Crepidula fornicata* is known to settle on surfaces such as bivalve shells and stone which can in time grow to form a dense aggregation which can smother bivalves and alter the habitat. *C. fornicata* have been recorded in a variety of habitats including sands with moderately strong tidal streams (De Montaudouin and Sauriau, 1999) and where they are present few other bivalves are known to live amongst them (Blanchard, 1997). Furthermore the colonial ascidian *Didemnum vexillum* is also highlighted as of concern as it is known to colonise artificial surfaces (Tillin, 2022; Tillin, 2023a; Tillin and Budd, 2023). Valentines *et al.* (2007) however noted that areas of mobile sand bordering communities of *Didemnum* spp. Were not affected by its presence and therefore concluded that this was not an appropriate habitat for this species.

2.11.7.7 The subtidal muddy sands with relatively species poor benthic communities IEF has a sedimentary and low energy nature and is considered to be at risk from the introduction of INNS due to the potential for establishment and difficulty removing them once they enter a habitat (De-Bastos and Hill, 2023a). The MarESA suggests this IEF has a medium overall sensitivity to this impact due to this difficulty in removing established species.

2.11.7.8 The seapens and burrowing megafauna communities IEF has been assessed as having a high sensitivity to the increased risk of introduction and spread of INNS (**Table 2.20**). The MarESA doesn't provide an assessment for the seapens and burrowing megafauna communities IEF however it does provide some research. For example, *Sternapsis scutata* is a non-native polychaete that has extended its range in inshore muddy sediments in the south west of the UK (Shelley *et al*., 2008). In a mesocosm experiment, little effect on biological functioning was detected after the introduction of the polychaete and a doubling of its biomass (Shelley *et al*., 2008). Also, as noted in **paragraph 2.11.7.6**, many of the INNS found in this region are found on coarse sediments or artificial structures such as ports and are not adapted to the sandy and muddy sediments that this IEF is found in.

2.11.7.9 The brittlestar beds IEF are particularly vulnerable to high densities of *C. fornicata*, which can cause ecological impacts on sedimentary habitats. The species can form dense carpets that can smother the seabed in shallow bays, changing and modifying the habitat structure. At high densities, the species physically smothers the sediment, and the resultant build-up of silt, pseudofaeces, and faeces is deposited and trapped within the bed (Tillin *et al*., 2020), negatively impacting the brittlestar beds integrity. It is possible that brittlestar beds may be able to feed on *Crepidula* larvae and prevent colonisation, but if they are able to colonise they will compete for space and evidence is not available to suggest that brittlestar beds will be able to maintain a community if this occurs (De-Bastos *et al*., 2023).

2.11.7.10 The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.7.11 The brittlestar beds IEF is deemed to be of medium vulnerability, low recoverability, and national importance. The sensitivity of the receptor is **medium**.

2.11.7.12 The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of medium vulnerability, low recoverability and national value. The sensitivity of the receptor is **medium**.

2.11.7.13 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.7.14 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

Fylde MCZ

2.11.7.15 The sensitivity of the Fylde MCZ IEFs to Increased risk of introduction and spread of INNS are presented in **Table 2.20**. These sensitivities are based on assessments made by the MarESA for the constituent biotopes.

2.11.7.16 For the subtidal sand IEF the sedimentary and high energy nature of the environment is challenging for most INNS with very few species able to colonise mobile sands due to the high levels of sediment disturbance (Tillin, 2022; Tillin and Budd, 2023). The characteristic biotopes of this protected feature (SS.SCS.ICS.MoeVen and SS.SMx.CMx.KurThyMx) are most at risk from the two species flagged in the MarESA sensitivity assessment as being of potential concern for sandy habitats, with this detailed above in **paragraph 2.11.7.5** for the subtidal habitat IEFs. Should INNS introduction occur, any effects are likely to be limited to the immediate vicinity of the cable protection and are unlikely to result in significant changes to the species composition of benthic communities associated with the subtidal sands IEF of the Fylde MCZ.

2.11.7.17 For the subtidal mud IEF the broad sensitivity is described above in **paragraph 2.11.7.7** for the subtidal habitat IEFs. A report by Tillin *et al.* (2020) for NRW conducted an evidence assessment for 16 INNS species that are either present or likely to arrive and may cause medium to high risk to marine ecosystems. The report assessed the risk to 41 Welsh MPAs, including MPAs with sublittoral mud features. The report identified a number of INNS which would consider sublittoral mud to be potentially suitable habitat including the Chinese mitten crab *Eriocheir sinensis,* the bryozoan *Watersipora subatra,* the red alga *Bonnemaisonia hamifera* and the Pacific oyster *Magallana gigas*.

2.11.7.18 The subtidal sand IEF is deemed to be of medium vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high**, based on a precautionary approach and a direct overlap of this MCZ with the Transmission Assets.

2.11.7.19 The subtidal mud IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

Table 2.20: Sensitivity of the benthic subtidal habitat IEFs to increased risk of introduction and spread of INNS

IEF	Representative biotope	Sensitivity to defined MarESA pressure Introduction or spread of INNS	Overall sensitivity (based on Table 2.14)
Subtidal habitats			
Subtidal coarse and mixed sediments with diverse benthic communities	SS.SCS.CCS SS.SMx.OMx SS.SMx.OMx.PoVen	High	High
	SS.SMx.CMx.KurThyMx	High	
Subtidal muddy sands with relatively species poor benthic communities	SS.SMu.CMuSa SS.SMu.CSaMu.LkorPpel	Medium	Medium
	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	
Subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities	SS.SSa.IFiSa SS.SSa.CFiSa SS.SSa.CFiSa.EpusOborApri	High	High
	SS.SSa.CMuSa.AalbNuc	Medium	
	SS.SSa.CFiSa.ApriBatPo	High	
Seapens and burrowing megafauna communities	SS.SMu.CFiMu.SpnMeg	No evidence	High
Brittlestar beds	SS.SMx.CMx.OphMx	Medium	Medium
Broadscale habitats: features of MCZs			
Subtidal mud	SS.SMu.CSaMu.AfilKurAnit SS.SMu.CSaMu	Not sensitive	Medium
	SS.SSa.IMuSa.EcorEns	Medium	
	SS.SMu.CSaMu.LkorPpel	Medium	
Subtidal sand	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	High
	SS.SCS.ICS.Glap	Medium	
	SS.SCS.ICS.MoeVen	High	
	SS.SSa.CMuSa.AalbNuc	Medium	
	SS.SMx.CMx.KurThyMx	High	

Intertidal habitat IEFs

2.11.7.20 As outlined in **section 2.11.5**, no artificial structures will be installed in the intertidal and most construction in the intertidal will likely be conducted by onshore vehicles which are unlikely to introduce marine INNS to the landfall. Whilst there may be the requirement for barge vessels to ground in the intertidal during installation at the landfall (see **Table 2.12**), the risk from INNS from these activities is considered to be minimal. No assessment of intertidal IEFs is therefore required for this impact.

Magnitude of impact

Subtidal habitat IEFs

2.11.7.21 The installation of artificial hard structures and the presence of construction vessels may lead to an increased risk of introduction and spread of INNS. The MDS in **Table 2.12** accounts for up to 286 vessel round trips during the construction phase, including those required during site preparation activities, which will occur over a maximum duration of up to four years (see **Table 2.12**). The MDS for the increased risk of introduction and spread of INNS impact is for the sequential construction scenario as this equates to the greatest time over which an increased risk of introduction and spread of INNS may occur. Although it should be noted that the total extent of artificial substrate is the same for both the concurrent and sequential scenarios.

2.11.7.22 There are however a number of existing vessel movements occurring within the study area. Ferries represent a large proportion of the vessel traffic in this region. These ferries primarily move between the mainland UK and Isle of Man, Ireland or Northern Ireland. One of the busiest crossings from Liverpool or Heysham to Douglas on the Isle of Man resulted in approximately 1,912 crossings in 2019 (Nash Maritime, 2022). Shipping is also a major contributor with busy ports such as Liverpool operating out of the region. There is also an active fishing industry in this region, with fishing ports such as Amlwch, Conwy, Douglas, Holyhead and Fleetwood being the most active. The addition of the Transmission Assets construction vessel activity does not represent a level of vessel activity uncommon to this area and, therefore, it does not represent a large increase in risk. Many of these vessels associated with the baseline vessel traffic will be travelling further afield than the construction vessels, and therefore at greater risk of exposure to INNS than those which will be involved in the construction of the Transmission Assets.

2.11.7.23 As presented in the MDS in **Table 2.12**, the risk of introduction and spread of INNS will be increased through the construction phase due to the introduction of 576,500 m^2 of artificial structures associated with cable protection.

2.11.7.24 Several INNS have been recorded along the English coast to the east of the Transmission Assets including species such as Wakame *Undaria pinnatifida*, carpet sea squirt *D. vexillum*, Darwin's barnacle *A.*

modestus, orange cloak sea squirt *Botrylloides violaceus*, trumpet tubeworm *Ficopotamus enigmaticus* and leathery sea squirt *Styela clava* (North West Wildlife Trust, 2016). The species *Ficopomatus enigmaticus* is a particular concern as they can become super abundant resulting in a significant biofouling hazard (North West Wildlife Trust, 2016). The government of the Isle of Man have identified that the killer shrimp *Dikerogammarus villosus* have the potential to establish populations within the Isle of Man territorial waters and should be given consideration in mitigation plans (MacNeil *et al*., 2012).

2.11.7.25 Many of the vessels used during the construction phase are likely to be from the region, therefore, the introduction of species from outside the region is unlikely. Some of the species already in the region however are known to spread as fouling on ships hulls which could result in their introduction into the Offshore Order Limits.

2.11.7.26 As a result of the likely movement of vessels around this region it is also possible that INNS which have been identified on the north Wales coast may also spread as a result of the construction activities. The NBN Atlas Wales (2018) has records of five invasive species along the north Wales coast and in the waters to the north. The most common INNS found on the north Wales coast is the modest barnacle *Austrominius modestus* which is native to New Zealand. Offshore, the Chinese diatom *Odontella sinensis* is an INNS of interest to Wales as of August 2020 and can be found offshore all along the Welsh coast. A Defra and Marine Strategy Framework Directive database also had a record of the Atlantic jack-knife clam *Ensis leei* on the north Wales coast; however there has been only one record of this species. The three other INNS (the compass sea squirt *Asterocarpa humilis* and the invasive species of red algae *Antithamnionella spirographidis* and *Bonnemaisonia hamifera*) can be found on the west coast of Anglesey around Holyhead port. This distance from any construction activity makes them unlikely to be spread as a result of the Transmission Assets. Recent monitoring from Beatrice offshore wind farm, off of the north west coast of Scotland, found no evidence of INNS colonisation on hard substrate such as foundations (APEM, 2021).

2.11.7.27 The NBN Atlas data indicates that *C. fornicata* has been found at few locations in the east Irish Sea, with one accepted identification near Liverpool and four identifications in the Menai Strait, and that *D. vexillum* has been identified in a few locations, within Holyhead port on Anglesey (NBN Atlas, 2023).

2.11.7.28 The carpet sea squirt *D. vexillum* has also been identified in the Holyhead region and is of particular concern. It tends to colonise artificial structures, rocks, boulders and even tide pools. It is usually found in low energy environments where water motion is limited (Gibson-Hall and Bilewitch, 2018). Efforts to remove this species once established have had short term success but have faced difficulties in long-term removal (Holt and Cordingley, 2011). Also, the slipper limpet *C. fornicata* has been identified in the north of Cardigan Bay, in the Menai Strait and off the north and west coast of Anglesey invasive in the shallow sublittoral (Rayment, 2008), and the American piddock

Petricolaria pholadiformis has also been identified along the north Wales coast at the mid-tide to low water (Budd, 2005).

2.11.7.29 As set out in **Table 2.11**, an Offshore EMP (CoT65) will be implemented which will aim to minimise the risk of potential introduction and spread of INNS. The plan will outline measures to ensure vessels comply with the International Maritime Organisation (IMO) ballast water management guidelines, it will consider the origin of vessels and contain standard housekeeping measures for such vessels as well as specific measures to be adopted in the event that a high alert species is recorded (e.g. carpet sea squirt *D. vexillum*). This will ensure that the risk of potential introduction and spread of INNS will be minimised.

2.11.7.30 The impact is predicted to be of local spatial extent and medium term duration during the construction phase. The magnitude will therefore be **low**.

Fylde MCZ

2.11.7.31 The MDS equates to the potential for up to 30,400 m^2 of artificial hard structures (i.e. cable protection) to be installed within the MCZ, which represents 0.012% of the total area of the MCZ. At the start of the construction phase the amount of introduced hard substrate will be greatly reduced and increase to the full amount by the end of the phase. Vessel movements will also occur within the MCZ during construction, although the amount of activity specifically in the MCZ area is unknown.

2.11.7.32 As set out in **Table 2.11** and discussed in **paragraph 2.11.7.29**, an Offshore EMP (CoT65) will be implemented as part of the Transmission Assets, which will include measures to minimise INNS. This will ensure that the risk of potential introduction and spread of INNS within the Fylde MCZ will be minimised.

2.11.7.33 The impact is predicted to be of local spatial extent and medium-term duration for both the features of the Fylde MCZ. The magnitude is therefore **low**.

Significance of effect

Subtidal habitat IEFs

2.11.7.34 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF and the seapens and burrowing megafauna communities IEF the sensitivity of the receptor is **high** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This is due to the relatively small proportion of hard substate which may be introduced into the Transmission Assets during the construction phase, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore measures have been adopted as part of the Transmission Assets to minimise the potential spread of INNS (CoT65).

2.11.7.35 Overall, for the subtidal muddy sands with relatively species poor benthic communities IEF and brittlestar beds IEF the sensitivity of the receptor is **medium**, and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant.

Fylde MCZ

2.11.7.36 Overall, for the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ, the sensitivity of the receptor is **medium** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion was reached due to the relatively small proportion of hard substate which may be introduced into the Fylde MCZ during the construction phase, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore, measures have been adopted (**Table 2.11**). as part of the Transmission Assets to minimise the potential spread of INNS (CoT65).

2.11.7.37 The effects of an increased risk of introduction and spread of INNS on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference: E4).

Operation and maintenance phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.7.38 The sensitivity of the subtidal habitat IEFs to INNS is as described previously for the construction phase in **paragraphs 2.11.7.4** to **2.11.7.13**.

2.11.7.39 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **high**.

2.11.7.40 The sensitivity of the brittlestar beds IEF is **medium**.

2.11.7.41 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

2.11.7.42 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **high**.

2.11.7.43 The sensitivity of the seapens and burrowing megafauna communities IEF is **high**.

Fylde MCZ

2.11.7.44 The sensitivities of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ are as described previously for the construction phase assessment in **paragraphs 2.11.7.15** to **2.11.7.17** and in **Table 2.20**.

2.11.7.45 The sensitivity of the subtidal sand IEF is **high**.

2.11.7.46 The sensitivity of the subtidal mud IEF of the Fylde MCZ is **medium**.

Magnitude of impact

Subtidal habitat IEFs

2.11.7.47 The installation of artificial hard structures and the presence of operation and maintenance vessels may lead to an increased risk of introduction and spread of INNS during the operation and maintenance phase. The MDS in **Table 2.12** accounts for up to 77 vessel return trips per year during the 35 year operation and maintenance phase. Furthermore, the long term introduction of 576,500 m^2 of hard artificial substrate in the form of cable protection has the potential to contribute to the introduction and spread of INNS.

2.11.7.48 Details of INNS of concern in the study area are as outlined previously in **paragraphs 2.11.7.24** to **2.11.7.28**.

2.11.7.49 The removal of encrusted growth may also occur during the operation and maintenance phase, however, no quantitative assessment can be made as the volume of encrusting is not known. Removal of marine growth has the potential to release invasive species if the materials and equipment used in the process have not been properly cleaned after use at a previous location that may have had invasive species present. To control this however an Offshore EMP (CoT65) will be implemented to reduce the transmission of species through actions involved in the operation and maintenance of the Transmission Assets (**Table 2.11**). Also vessels will have to comply with the IMO ballast water management guidelines. These measures will ensure that the risk of potential introduction and spread of INNS will be minimised.

2.11.7.50 The impact is predicted to be of local spatial extent and long term duration. The magnitude is therefore **low**.

Fylde MCZ

2.11.7.51 During the operation and maintenance phase of the Transmission Assets the extent of introduced artificial hard structures within the MCZ (i.e. cable protection) will be the same as that defined for the construction phase in **paragraph 2.11.7.31**. Vessel movements may occur within the MCZ associated with maintenance activities however this in anticipated be a small proportion of the overall vessel movements described in **paragraph 2.11.7.47**.

2.11.7.52 The impact is predicted to be of local spatial extent and long-term duration for both the features of the Fylde MCZ. The magnitude is therefore **low**.

Significance of effect

Subtidal habitat IEFs

2.11.7.53 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF and the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is **high** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion is based on the relatively small proportion of hard substate which may be introduced into the Transmission Assets during this phase, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore, measures have been adopted as part of the Transmission Assets to minimise the effects from the introduction or spread of INNS.

2.11.7.54 Overall, for the subtidal muddy sands with relatively species poor benthic communities IEF and the brittlestar beds IEF the sensitivity of the receptor is **medium**, and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant.

Fylde MCZ

2.11.7.55 Overall, for the subtidal sand IEF of the Fylde MCZ, the sensitivity of the receptor is **high** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This is due to the relatively small proportion of hard substate which may be introduced into the Fylde MCZ during the operation and maintenance phase, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore, measures have been adopted (CoT65, **Table 2.11**) as part of the Transmission Assets to minimise the effects from introduction or spread of INNS.

2.11.7.56 Overall, for the subtidal mud IEF of the Fylde MCZ, the sensitivity of the receptor is **medium** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant.

2.11.7.57 The effects of an increased risk of introduction and spread of INNS on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference: E4).

Decommissioning phase

2.11.7.58 The presence of any Transmission Assets infrastructure which is left *in situ* post-decommissioning, together with vessel movements, may contribute to the continued introduction and spread of INNS. As detailed in commitment CoT108 and CoT109 (**Table 2.11**), all external cable protection used within the Fylde MCZ will be designed to be removable on decommissioning with the requirement for removal agreed with stakeholders and regulators at the time of decommissioning. Therefore this impact within the Fylde MCZ will not persist beyond the decommissioning phase and so has not been assessed further.

Sensitivity of receptor

Subtidal habitat IEFs

2.11.7.59 The sensitivity of the subtidal sedimentary IEFs to INNS is as described previously for the construction phase in **paragraphs 2.11.7.4** to **2.11.7.13**.

2.11.7.60 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **high**.

2.11.7.61 The sensitivity of the brittlestar beds IEF is **medium**.

2.11.7.62 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

2.11.7.63 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **high**.

2.11.7.64 The sensitivity of the seapens and burrowing megafauna communities IEF is **high**.

Magnitude of impact

Subtidal habitat IEFs

2.11.7.65 The presence of decommissioning vessels may lead to an increased risk of introduction and spread of INNS. The MDS in **Table 2.12** accounts for up to 286 vessel return trips during the decommissioning phase. Permanent habitat creation (i.e. persisting post-decommissioning) of up to 576,500 m^2 due to the presence of cable protection left *in situ* (0.093% of the Offshore Order Limits) may also contribute to an increased risk of introduction and spread of INNS.

2.11.7.66 As set out in **Table 2.11**, an Offshore EMP (CoT65) will be implemented as part of the Transmission Assets, which will include measures to minimise the introduction and spread of INNS.

2.11.7.67 The impact is predicted to be of local spatial extent and long term duration. The magnitude is there **low**.

Significance of effect

Subtidal habitat IEFs

2.11.7.68 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF and the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is **high** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This is due to the relatively small proportion of hard substate which may remain post-decommissioning, and the small uplift in vessel traffic which could facilitate the introduction of INNS.

Furthermore measures have been adopted as part of the Transmission Assets to minimise the potential spread of INNS (CoT65, **Table 2.11**).

2.11.7.69 Overall, for the subtidal muddy sands with relatively species poor benthic communities IEF and the brittlestar beds IEF the sensitivity of the receptor is **medium**, and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant.

2.11.8 Removal of hard substrate

2.11.8.1 The removal of hard substrates associated with the removal of the cable protection during the decommissioning phase will have a direct effect on benthic subtidal habitat IEFs, with the seabed returning to the mixed, sandy and muddy sediments following removal of structures.

2.11.8.2 The relevant MarESA pressure and benchmark which has used to inform this impact assessment is:

- physical change (to another substratum type): change in sediment type by one Folk class (Long, 2006) (based on UK SeaMap simplified classification) and change from sedimentary or soft rock substrata to hard rock or artificial substrata or vice-versa.

Decommissioning phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.8.3 The removal of infrastructure associated with the Transmission Assets during the decommissioning phase would result in localised declines in biodiversity as it would remove any communities which had established themselves on the hard substrate. However, areas of seabed where the Transmission Assets infrastructure was present prior to decommissioning (i.e. footprints of the cable protection) would be expected to recover, with benthic communities in these areas recolonising habitats previously lost beneath the infrastructure.

2.11.8.4 As discussed in **paragraph 2.11.2.34**, a review undertaken by RPS (2019) found communities in coarse and mixed sediments are likely to recover within five years of disturbance (Desprez, 2000; Newell *et al*., 1998; Pearce *et al*., 2007), but in some cases, recovery has been reported as taking up to nine years in muddy sediments following cessation of dredging (Foden *et al*., 2009). Sandy sediments are likely to recover from disturbance (e.g. aggregate extraction or dredging) within a shorter time period (e.g. months to up to two years; Newell *et al.,* 2004).

2.11.8.5 The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.8.6 The brittlestar beds IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.8.7 The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.8.8 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

2.11.8.9 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.

Magnitude of impact

Subtidal habitat IEFs

2.11.8.10 The decommissioning of the Transmission Assets infrastructure may result in the removal of up to 576,500 m^2 of infrastructure associated with the offshore export cable protection and cable crossing protection, resulting in the loss of the associated colonising communities. This equates to an impact on 0.093% of the Offshore Order Limits.

2.11.8.11 The impact is predicted to be of local spatial extent and long term duration due to time likely required for the underlying sedimentary habitat to recover to baseline conditions. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

2.11.8.12 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and the seapens and burrowing megafauna communities IEF the sensitivity of the receptor is **high** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion is based on the ability of the sedimentary habitats to recover following decommissioning and the small scale of the change in relation to the wider study area.

2.11.9 Changes in physical processes

2.11.9.1 Changes in physical processes may arise during the operation and maintenance phase and the decommissioning phase from the installation of infrastructure into the water column, including scour effects and changes in the sediment transport and wave regimes resulting in potential effects on benthic subtidal and intertidal receptors. Volume 2, Chapter 1: Physical processes of the ES provides a full description of the desk-based analysis used to inform this assessment.

2.11.9.2 The relevant MarESA pressures and benchmarks used to inform this impact assessment are:

- changes in local water flow (tidal current): change in peak mean spring bed flow velocity between 0.1 m/s to 0.2 m/s for more than one year. The pressure is associated with activities that have the potential to modify hydrological energy flows. This pressure corresponds to the impacts associated with the presence of cable protection; and
- local wave exposure changes: change in nearshore significant wave height > 3% but < 5% for one year. This pressure corresponds to the impacts associated with the presence of cable protection.

Operation and maintenance phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.9.3 The presence of the Transmission Assets infrastructure may obstruct tidal flow and lead to changes in the wave regime. The sensitivities of the subtidal habitat IEFs to the identified MarESA pressures are presented in **Table 2.21**.

2.11.9.4 The subtidal coarse and mixed sediments with diverse benthic communities IEF and the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF are both assessed as being not sensitive to either of the MarESA pressures identified as most of these biotopes are exposed to a variety of tidal regimes. The minimal level of predicted change associated with these impacts makes it highly unlikely these biotopes will be challenged physiologically by these conditions even where specific environmental conditions are required for a biotope. Changes in water flow may alter the topography of the habitat and may cause some shifts in abundance (Tillin, 2023a) resulting in a spatial and demographic shift which is unlikely to lead to any notable changes in these biotopes as a whole. Representative species such as *Glycera* spp. are known to be present in areas of mobile sands (Roche *et al*., 2007), but tend to prefer extremely sheltered areas (Connor *et al*., 2004), but have a high resistance to both local wave exposure changes and changes in local water flow. These IEFs occur in the subtidal and therefore will not be exposed to any change in wave patterns.

2.11.9.5 The subtidal muddy sands with relatively species poor benthic communities IEF is largely not sensitive to these pressures, with a decrease in water movement potentially increasing deposition rate of suspended sediments (Hiscock, 1983), increasing food supplies to filter feeders such as *L. koreni* which comprise a large proportion of the benthos within this IEF. The most damaging effect of increased flow rate would be the erosion of the substratum as this could eventually lead to loss of the habitat, primarily by resuspending and preventing deposition of finer particles (Hiscock, 1983). The very low level of change predicted to arise as a result of the Transmission Assets, however, makes this an unlikely outcome (e.g. sand particles are most easily eroded and likely to be eroded at about 0.20 m/s (Sundborg, 1956), higher than the levels of change expected from the Morgan Offshore Wind Project: Generation Assets). Furthermore, the impact of changes in wave conditions is likely to be low as wave action reduces with depth, and the biotope occurs below 10 m where wave mediated flow will be reduced (De-Bastos, 2023). The potentially present seapens and burrowing megafauna in circalittoral fine mud biotope has a high sensitivity to the local change of water flow, with water flow increases potentially negatively impacting filter feeding rates of seapens due to physical damage (Best, 1983). However, no seapens were noted as present within the Offshore Order Limits, and the burrowing megafauna which are present are not sensitive to this impact.

2.11.9.6 The seapens and burrowing megafauna communities IEF is assessed as not sensitive to changes in wave exposure and it has a high sensitivity to water flow changes. This high sensitivity is due to the specialised nature of this community which is adapted to low energy environments. As water flow rates increase, *V. mirabilis* first responds by swinging polyps around the axial rod to face away from the current. With further increase in flow, the stalk bends over and >0.5 m/s tentacles retract, and the stalk retracts into the mud (Hiscock, 1983), which is a much higher flow than is predicted to arise as a result of the presence of infrastructure within the Transmission Assets. A long term retreat would lead to a loss of population as they would not be able to feed. It should be noted that no seapens were recorded within the survey area. Similar behaviour could be exhibited by other kinds of burrowing megafauna. Regarding burrowing megafauna such as *Nephrops norvegicus* (noting this species has not been identified in the Transmission Assets), they are likely to be tolerant of changes in water flow rates due to their burrow dwelling lifestyle however increases in water flow may inhibit larvae settlement (Hill and Sabatini, 2008). In addition, long-term increases in water flow are likely to modify the sediment, removing the fine sediments the seapens require in favour of sandier, coarser sediments. The predicted small scale changes, especially at the edge of the ZOI for the Transmission Assets, mean it is unlikely that the habitat and communities will be adversely affected. Wave exposure change is not considered likely to affect this community because this biotope only occurs in wave sheltered environments.

2.11.9.7 The brittlestar beds IEF has an overall negligible sensitivity to changes in physical processes (**Table 2.21**). This is because brittlestars are found in a range of tidal levels from the restricted flow of lochs to the high energy environment of open coastlines (Connor *et al*., 2004). This also applies to wave exposure where brittlestar beds have been found to occupy moderately exposed and sheltered areas (Connor *et al*., 2004). Increased flow rates, increases suspension and transport of organic particles can enhance feeding rates. If the flow is too strong, brittlestars may flatten, link arms, or withdraw arms into the sediment (De-Bastos *et al*., 2023).

2.11.9.8 The low resemblance stony reef IEF is assessed as being not sensitive to the relevant pressure because only a substantial decrease in water flow would result in the decline in this biotope. The characteristic fauna of this biotope are predominantly passive filter feeders which require a strong enough current to carry food into their range. They are therefore adapted to moderate tidal streams but maladapted to low level currents. The minimal level of change associated with this impact however makes it unlikely conditions detrimental to this biotope will be produced. Additionally in the Transmission Assets this IEF occurs entirely in subtidal conditions and therefore will not be exposed to any change in wave exposure.

2.11.9.9 The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**.

2.11.9.10 The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**.

2.11.9.11 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**.

2.11.9.12 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore considered to be **high** (reduced to **medium** in absence of seapens).

2.11.9.13 The brittlestar beds IEF is deemed to be of low vulnerability, high recoverability, and national value. The sensitivity of the receptor is **negligible**.

2.11.9.14 The low resemblance stony reef IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**.

Shell Flat and Lune Deep SAC

2.11.9.15 The presence of the Transmission Assets may obstruct tidal flow and lead to changes in the wave regime to the Shell Flat and Lune Deep SAC, 5.72 km from the Transmission Assets. The sensitivities of the Shell Flat and Lune Deep SAC IEFs to the identified MarESA pressures are presented in **Table 2.21**.

2.11.9.16 Water flow has been shown to be important for the development of bryozoans (Ryland, 1976), such as those which inhabit the reef feature of the Shell Flat and Lune Deep SAC, as they are dependent on water flow to provide adequate food supplies (McKinney, 1986). A significant increase or decrease in the tidal flow conditions could lead to adverse effect on the bryozoans which this community is composed, reducing food availability or feeding efficiency respectively (Tyler-Walters, 2005;

Okamura, 1984). One of the key species, the bryozoan *F. Foliacea,* is less abundant in weak currents but known to occur in high abundances in strong tidal streams (Stebbing, 1971). *F. foliacea* also occur in habitats with a range of wave exposure, from very exposed to sheltered waters, however very high wave action can be detrimental resulting in the removal of *F. foliacea* from its hard substratum (Hayward and Ryland, 1995). Some other key members of this community including the ascidian *C. lepadiformis* are more dominant in waters with low flow rates and high SSCs (De Caralt *et al*., 2002), whereas high flow rates are likely to be create adverse feeding conditions. Sponges are also a key part of this reef community, the composition of sponges at a site can depend on the conditions including current energy and exposure, therefore a significant change in conditions could lead to a change in this community. Any changes in conditions would need to be substantial to result in any changes to community structure and that is unlikely based on the scale of the changes in physical processes anticipated for the SAC due to the distance from any infrastructure which would result in physical processes changes.

2.11.9.17 For the sandbanks which are slightly covered by sea water all the time IEF as a sedimentary habitat the hydrodynamic regime is important to determine the structure of this habitat (De-Bastos, 2023). Although changes in water flow would be likely to change the sedimentary regime in the biotope, the cohesive nature of the sandy muds that characterise the biotope is likely to provide some protection to changes in water flow (De-Bastos, 2023). Adverse effects regarding changes in tidal flow rates would be most likely to occur as a result of an increase in flow which could lead to erosion of the feature and changes to the sediment characterisation of the feature (Hiscock, 1983; De-Bastos, 2023). Strong wave action could also lead to damage to the delicate structures of the characteristic communities and potentially dislodge characteristic fauna causing mortality. One such example of mortality was observed by Rees *et al*. (1977) who observed large numbers of *A. alba* cast ashore following winter gales in North Wales. Some species in this community however are adapted for strong currents and exposed wave conditions such as *Magelona mirabilis* (Lackshewitz and Reise, 1998). Alternatively a decrease in flow may result in an increase in siltation which could result in an increase in food availability for some species (De-Bastos, 2023). Any changes in conditions would need to be substantial to result in any changes to community structure and that is unlikely based on the scale of the changes in physical processes anticipated for the SAC due to the distance from any infrastructure which would result in physical processes changes.

2.11.9.18 The sandbanks which are slightly covered by sea water IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

2.11.9.19 The reef IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

Fylde MCZ

2.11.9.20 The presence of the Transmission Assets infrastructure may obstruct tidal flow and lead to changes in the wave regime. The sensitivities of the Fylde MCZ IEFs to the identified MarESA pressures are presented in **Table 2.21**.

2.11.9.21 The subtidal sand IEF of the Fylde MCZ is found in strong to moderately strong tidal currents (3.0 m/s to 0.5 m/s), however an increase beyond the established conditions could result in the erosion of sediment changing the structure and topography of this feature (Tillin, 2023a; Tillin, 2022; Tillin and Budd, 2023). Many of the species which make up the communities in these habitats inhabit a variety of sediment types which would suggest they would not be sensitive to the potential effects of changes to physical processes. Furthermore species such as the polychaetes *Owenia fusiformis* and *L. conchilega* build tubes out of sediment which can act to stabilise the sediment (Somaschini, 1993). Wave exposure can also lead to erosion of the sediment however as a subtidal habitat the features of the Fylde MCZ would only be affected indirectly. The indirect effects may include changes to food and larvae supply however these effects are likely to be negligible based on the conditions experienced in this habitat.

2.11.9.22 The subtidal mud IEF of the Fylde MCZ has a specific sediment composition which could be altered by changes in physical processes such as tidal currents and wave exposure. An increase in flow rate could lead to the erosion of sediment which could leave behind coarse sediments which are unsuitable for the burrowing communities which inhabit this feature. A decrease in flow would lead to an increase in the fine sediment component of the substrate which would also lead to a shift in some of the characterising species of this community such as *Ensis* Sp. and *E. cordatum* but would benefit other species by increasing food availability. The effects of wave exposure change would be minimal on this habitat based on the depth at which it is found within the Fylde MCZ. Some species in this community have been found to be resistant to such changes including *E. Cordatum* which has been recorded at a range of wave exposures (Tillin and Tyler-Walters, 2014). Other species however would be damaged by an increase in wave exposure such as *A. filiformis* which would be likely to be broken up by strong wave exposure (De-Basto and Hill, 2023a). In a study of *L. koreni* in Colwyn Bay, the author reported using samples of a nearby population which had supposedly settled at the same time, with reduced wave action being suggested as a possible reason to explain the length of survival difference between the two communities (Nicolaidou, 1983). Furthermore, the author reported that growth of the species ceased completely during the winter, probably due to disturbance by storms, as well as temperature (Nicolaidou, 1983). This would however require a sustained sizable increase in wave exposure which is not on the same scale of change expected within the Fylde MCZ.

2.11.9.23 The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

2.11.9.24 The subtidal mud IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

West of Walney MCZ

2.11.9.25 The presence of the Transmission Assets infrastructure may obstruct tidal flow and lead to changes in the wave regime to the West of Walney MCZ, 5.85 km from the Transmission Assets. The sensitivities of the West of Walney MCZ IEFs to the identified MarESA pressures are presented in **Table 2.21**.

2.11.9.26 The subtidal mud IEF and subtidal sand IEF of the West of Walney MCZ are assessed by the MarESA as not sensitive to the pressures associated with changes in physical processes. Sand and mud particles can be eroded with increased water flow rates or wave exposure however the characteristic species of this biotope, *A. filiformis, K. bidentata* and *Thyasira* Sp. has been found in a range of tidal flow rates and *A. filiformis* are capable of changing from filter to deposit feeding depending on the conditions (Ockelmann and Muus, 1978). Furthermore, as these biotopes occur in circalittoral habitats, they are not directly exposed to the action of breaking waves and therefore unlikely to be affected by changes in wave patterns. The adaptable nature of this community alongside the predicted small scale changes in tidal currents and wave patterns makes it unlikely that these IEFs will be adversely affected.

2.11.9.27 The seapens and burrowing megafauna communities IEF are assessed to have the same sensitivity as in the subtidal habitat IEFs as detailed in **paragraph 2.11.9.6**.

2.11.9.28 The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

2.11.9.29 The subtidal mud IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

2.11.9.30 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore considered to be **high**, reduced to **medium** in the absence of seapens.

West of Copeland MCZ

2.11.9.31 The presence of the Transmission Assets infrastructure may obstruct tidal flow and lead to changes in the wave regime to the West of Copeland MCZ, 6.32 km from the Transmission Assets. The sensitivities of the West of Copeland MCZ IEFs to the identified MarESA pressures are presented in **Table 2.21**.

2.11.9.32 The representative biotopes of the subtidal coarse sediment IEF and subtidal mixed sediment IEF of the West of Copeland MCZ have been identified as not sensitive to the relevant pressures. The explanation for this sensitivity is described in **paragraph 2.11.9.4**.

2.11.9.33 The sensitivity of the subtidal sand IEF is the same described for this IEF in the West of Walney MCZ (**paragraphs 2.11.9.25** to **2.11.9.30**). This habitat could be adversely affected by an increase in tidal currents which may erode the sediment however the scale of the change which has been modelled to result from the Transmission Assets is unlikely to result in any adverse effect.

2.11.9.34 The subtidal coarse sediment IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

2.11.9.35 The subtidal mixed sediment IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

2.11.9.36 The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

Intertidal habitat IEFs

2.11.9.37 The presence of the Transmission Assets infrastructure may obstruct tidal flow and lead to changes in the wave regime. The sensitivities of the intertidal habitat IEFs to the identified MarESA pressures are presented in **Table 2.21**.

2.11.9.38 The intertidal habitat IEFs are broadly not sensitive to the identified MarESA pressures. The detectable impacts on these relevant biotopes included a slight reduction in medium term recruitment and therefore density *of L. conchilega* where wave and tidal current action has decreased (Harvey and Bourget, 1995). Also, *Ensis* populations have the potential to decrease if tidal currents and wave exposure were to increase (Rees *et al*., 1976). These minor impacts indicate a lack of sensitivity to these pressures in the species poor/barren sands IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF, as well as the polychaete/bivalve-dominated muddy sand shores IEF.

2.11.9.39 The biotope LS.LSa.MuSa.MacAre within the polychaete/bivalve-dominated muddy sand shores IEF is more likely to be impacted by changes in sediment transport caused by change in local water flows. At low current velocities *A. marina* casts and burrows enable the deposition and adherence of macroalgae (Puls *et al*., 2012). At high current velocities *A. marina* casts are quickly eroded and sediment particles are suspended in the water column. Therefore, an increase in water flow may cause the depletion of fine particle matter, leaving coarser particles and change the sediment type (Wendelboe *et al*., 2013). This biotope has therefore been assessed as having a medium sensitivity to this pressure, but it is not sensitive to local wave exposure changes due to existing naturally in wave-exposed intertidal areas, and this biotope is only one of the constituent biotopes in this IEF, all of which are otherwise not sensitive.

2.11.9.40 The species poor/barren sands IEF is deemed to be of low vulnerability, recoverability and national value. The sensitivity of the receptor is **negligible**.

2.11.9.41 The polychaete/bivalve-dominated muddy sand shores IEF is deemed to be of low to negligible vulnerability and medium recoverability and, based on assessments made by the MarESA, is of overall no to medium sensitivity to the MarESA pressures associated with this impact. This polychaete/bivalve-dominated muddy sand shores IEF is of national value and therefore a precautionary approach has been adopted to assigning the overall level of sensitivity according to **Table 2.14**. The sensitivity of the receptor is considered to be **medium**.

2.11.9.42 The *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is deemed to be of low vulnerability, recoverability and national value. The sensitivity of the receptor is **negligible**.

Table 2.21: Sensitivity of the benthic IEFs to changes in physical processes

IEF	Representative biotope	Sensitivity to defined MarESA pressure		Overall sensitivity (based on Table 2.14)
		Changes in local water flow (tidal current)	Local wave exposure changes	
Subtidal habitats				
Subtidal coarse and mixed sediments with diverse benthic communities	SS.SCS.CCS SS.SMx.OMx SS.SMx.OMx.PoVen	Not sensitive	Not sensitive	Negligible
	SS.SMx.CMx.KurThyMx	Not sensitive	Not sensitive	
Subtidal muddy sands with relatively species poor benthic communities	SS.SMu.CMuSa SS.SMu.CSaMu.LkorPpel	Not sensitive	Not sensitive	Negligible
	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	Not sensitive	
Subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities.	SS.SSa.IFiSa SS.SSa.CFiSa SS.SSa.CFiSa.EpusOborApri	Not sensitive	Not sensitive	Negligible
	SS.SSa.CMuSa.AalbNuc	Not sensitive	Not sensitive	
	SS.SSa.CFiSa.ApriBatPo	Not sensitive	Not sensitive	
Low resemblance stony reef	CR.HCR.XFa.SpNemAdia	Not sensitive	Not sensitive	Negligible
Seapens and burrowing megafauna communities	Potential SS.SMu.CFiMu.SpnMeg	High	Not sensitive	High (although in the absence of seapens sensitivity is considered to be Medium)
Brittlestar beds	SS.SMx.CMx.OphMx	Not sensitive	Not sensitive	Negligible

IEF	Representative biotope	Sensitivity to defined MarESA pressure		Overall sensitivity (based on Table 2.14)
		Changes in local water flow (tidal current)	Local wave exposure changes	
Broadscale habitats: features of MCZs				
Subtidal mud	SS.SMu.CSaMu.AfilKurAnit SS.SSa.CMuSa	Not sensitive	Not sensitive	Negligible
	SS.SSa.IMuSa.EcorEns	Not sensitive	Not sensitive	
	SS.SMu.CSaMu.LkorPpel	Not sensitive	Not sensitive	
Subtidal sand	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	Not sensitive	Negligible
	SS.SCS.ICS.Glap	Not sensitive	Not sensitive	
	SS.SCS.ICS.MoeVen	Not sensitive	Not sensitive	
	SS.SSa.CMuSa.AalbNuc	Not sensitive	Not sensitive	
	SS.SMx.CMx.KurThyMx	Not sensitive	Not sensitive	
Subtidal coarse sediment	SS.SCS.CCS	Not sensitive	Not sensitive	Negligible
Subtidal mixed sediment	SS.SMx.OMx SS.SMx.OMx.PoVen	Not sensitive	Not sensitive	Negligible
Seapens and burrowing megafauna communities	SS.SMu.CFiMu.SpnMeg	High	Not sensitive	High (although in the absence of seapens sensitivity is considered to be Medium)
Intertidal habitats				
Species poor/barren sands	LS.LSa.FiSa LS.LSa.MoSa	Not sensitive	Not sensitive	Negligible
Polychaete/bivalve-dominated muddy sand shores	LS.LSa.MuSa LS.LSa.MuSa.MacAre	Medium	Not sensitive	Medium
	LS.LSa.MuSa.Lan	Not sensitive	Not sensitive	
Echinocardium cordatum and *Ensis* spp. In lower shore and shallow sublittoral slightly muddy fine sand	SS.SSa.IMuSa.EcorEns	Not sensitive	Not sensitive	Negligible

Magnitude of impact

Subtidal habitat IEFs

2.11.9.43 The presence of infrastructure relating to the Transmission Assets may lead to changes in wave regime during the operation and maintenance phase and the MDS is as outlined in **Table 2.12**. Specific modelling was not undertaken for this impact, with the assessment instead being based on and adapted from modelling for nearby projects, such as the Mona Offshore Wind Project. It is anticipated that cable protection may be required, however, this would only be necessary where a suitable burial depth may not be achieved due to ground conditions or the presence of existing infrastructure (i.e. cable crossing is required) in line with commitment CoT54 outlined in **Table 2.11**. It is also noted that, in line with best practice and commitment CoT114 (**Table 2.11)** all permanent infrastructure located between MLWS and MHWS will be buried to a target depth of 3 m The Outline Offshore CSIP details that low profile/tapered cable protection would be employed in shallow water should this be required (CoT45, **Table 2.11)**. Additionally commitment CoT47 (**Table 2.11)**, aims to limit the extent of cable protection in the Fylde MCZ. Where practicable the requirements will be compliant with the MCA navigation guidance which includes that there will be no more than a 5% reduction in water depth (referenced to Chart Datum) at any point along the cable route without prior consultation with the MCA and relevant licencing authorities (MCA, 2021).

2.11.9.44 Although cable protection was included in the Morgan Offshore Wind Project: Generation Assets ES modelling its impact on physical processes is not readily isolated from the infrastructure as a whole. However, as part of the Mona Offshore Wind Project ES modelling related to cable protect was provided along sections of the export cable.

2.11.9.45 In the case of wave climate where the cable protection height was less than approximately 15% of the water depth there was no change in wave climate; whilst in shallower water the change was 0.5 to 1% of background levels at the site of cable protection reducing rapidly with distance and indistinguishable from background levels within 1 km of the site.

2.11.9.46 For tidal currents, where cables were perpendicular to tidal currents and continuous length of cable protection was provided there was a highly localised increase in current speed of circa 1% as flow is accelerated over and around the structure due to the depth reduction. The area influenced extended circa 500 m from the structure however the influence diminished rapidly within this zone.

2.11.9.47 With regards to the impact of cable protection on sediment transport pathways, the magnitude of the impact would be highly dependent on the length and orientation of the cable protection. Baseline sediment transport, driven by residual tidal currents, runs in an easterly direction offshore and therefore largely parallel to the cable routes. However closer inshore the sediment transport is parallel to the coast and where cable protection, if required, may be perpendicular to these pathways. If and where cable protection is required in shallow subtidal conditions, the measures used will be of sufficiently low profile to cause minimal interruption to sediment transport. Descriptions of the possible types of cable protection to be utilised can be found in Volume 1, Chapter 3: Project description of the ES and further outlined within the Outline Offshore CSIP (document reference J15) (CoT45, **Table 2.11**) in order to ensure that the most suitable protection is applied in line with the Applicants commitments.

2.11.9.48 To minimise the potential impact from the cables and removal of cables there is a commitment to bury cables where possible (CoT54, **Table 2.11**). Where burial cannot be achieved to the required depth, cable protection may be required. The Outline CBRA (document reference J14) and Outline Offshore CSIP (document reference J15) (CoT45, **Table 2.11**), establishes these parameters. The detail of design and construction will be outlined within the detailed CSIPs and within CMSs (CoT49, **Table 2.11**) which will determine the likely extent of any potential scour and would aim to mitigate this through site specific detailed design of cable protection measures. It is therefore likely that any secondary scour effects associated with cable protection would be confined to within a few meters of the direct footprint of that cable protection material (CoT49, **Table 2.11**).

2.11.9.49 The impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility. The magnitude is therefore **low**.

Shell Flat and Lune Deep SAC

2.11.9.50 The Transmission Assets does not directly overlap with the Shell Flat and Lune Deep SAC, which is situated 5.72 km to the north of the Offshore Order Limits. As described in Volume 2, Chapter 1: Physical processes of the ES, and above for the subtidal habitat IEFs in **paragraphs 2.11.9.43** to **2.11.9.49**, the changes in physical processes impacts will be limited to approximately 1 km of the cables.

2.11.9.51 Therefore, given the distance of the SAC from the Transmission Assets, the impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility. The magnitude is therefore **no change**. This is due to the lack of overlap with the Transmission Assets, or the predicted 5 km sediment plume.

Fylde MCZ

2.11.9.52 The Transmission Assets overlaps with the Fylde MCZ, with this therefore leading to potential changes in physical processes from the presence of cable protection within the Fylde MCZ if installation is deemed necessary. As described in Volume 2, Chapter 1: Physical processes of the ES, localised changes in wave climate, tidal currents and the sediment transport regime may potentially be experienced within the Fylde MCZ as described in **paragraphs 2.11.9.43** to **2.11.9.49** and within 1 km of the cable protection. The magnitude of the impact of cable protection on sediment transport pathways would be highly dependent on the length and orientation of the infrastructure. This has been minimised through commitments to reduce the amount of cable protection within the Fylde MCZ where practical (CoT47) with the Outline Offshore CSIP (document reference J15) including for cable burial as the preferred option for cable protection, where practicable (CoT54) as outlined in **Table 2.11.** Baseline sediment transport, driven by residual tidal currents, runs in an easterly direction offshore and therefore largely parallel to the cable routes.

2.11.9.53 The impact is predicted to be of local spatial extent and long term duration. The magnitude is therefore **low**.

West of Walney MCZ

2.11.9.54 The Transmission Assets does not directly overlap with the West of Walney MCZ, which is situated 5.85 km to the north of the Offshore Order Limits. The magnitude of the predicted changes to physical processes at the West of Walney MCZ is as described in **paragraphs 2.11.9.43** to **2.11.9.49**, the changes in physical processes impacts will be limited to within approximately 1 km of the cables. Changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect the West of Walney MCZ. Therefore, given the distance of the MCZ from the Transmission Assets, changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect the West of Walney MCZ.

2.11.9.55 The magnitude is therefore **no change**, and no effect will arise on the West of Walney MCZ.

West of Copeland MCZ

2.11.9.56 The Transmission Assets does not directly overlap with the West of Copeland MCZ, which is situated 6.32 km to the north of the Offshore Order Limits. The magnitude of the predicted changes to physical processes at the West of Copeland MCZ is described in **paragraphs 2.11.9.43** to **2.11.9.49**, the changes in physical processes impacts will be limited to within approximately 1 km of the cables. Changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect the West of Copeland MCZ. Therefore, given the distance of the MCZ from the Transmission Assets, changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect the West of Copeland MCZ.

2.11.9.57 The magnitude is therefore **no change,** and no effect will arise on the West of Copeland MCZ.

Intertidal habitat IEFs

2.11.9.58 Given the impact of subtidal cable protection will be limited to the immediate vicinity of the site of cable protection, it is not expected to affect adjacent shorelines or associated intertidal habitat IEFs. However, any impact would be mitigated as CoT45 (**Table 2.11**) commits to no more than 5% reduction in water depth (referenced to Chart Datum) will occur at any point on the offshore export cable corridor route without prior written approval from the MCA.

2.11.9.59 It is assumed, in line with best practice, all permanent infrastructure located between MLWS and MHWS will be buried to a target depth of 3 m as per CoT114, **Table 2.11** and the Outline Offshore CSIP (document reference J15) includes for low profile/tapered cable protection to be employed in shallow water should this be required (CoT45, **Table 2.11)**. Cable protection heights will be compliant with the MCA navigation guidance which states that there will be "…No more than a 5% reduction in water depth (referenced to Chart Datum) at any point on the offshore export cable corridor route without prior written approval from the MCA…" (MCA, 2021).

2.11.9.60 At the landfall, to ensure no exposure of cabling occurs in the event of open-cut trenching, a target depth of 5 m for each of the six export cables within the intertidal has been assigned. Given natural beach variability falls within 1 m to 3 m it can be expected that trenching to this depth will avoid cable exposure (ABPmer 2023). Trenches will then be backfilled to beach level therefore, in the event of trenching techniques there will be no interruption in sediment transport pathways at the landfall following construction.

2.11.9.61 In the event that trenchless techniques are utilised for landfall installation, a cofferdam would be required to ensure a dry working environment for punch out. In this event the cofferdam will act as a physical obstacle to sediment transport within the intertidal region, however this impact would be of a temporary nature with the cofferdam removed post construction.

2.11.9.62 The impact is predicted to be of local spatial extent and long term duration. The magnitude is therefore **negligible**.

Significance of effect

Subtidal habitat IEFs

2.11.9.63 Overall, for most of the subtidal IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal muddy sands with relatively species poor benthic communities IEF, subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, low resemblance stony reef IEF and the brittlestar beds IEF and) the sensitivity of the receptor is **negligible** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for.

2.11.9.64 Overall, for the seapens and burrowing megafauna communities IEF, the sensitivity is high, reduced to **medium** due to the absence of seapens, and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant.

Shell Flat and Lune Deep SAC

2.11.9.65 Overall for the sandbanks which are slightly covered by sea water all the time and reef IEFs of the Shell Flat and Lune Deep SAC, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **no change**. There will, therefore, be **no effect** on the IEFs of the Shell Flat and Lune Deep SAC.

Fylde MCZ

2.11.9.66 Overall for the subtidal sand IEF and subtidal mud IEF of the Fylde MCZ, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** significance, which is not significant. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for.

2.11.9.67 The effects of changes in physical processes on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference: E4).

West of Walney MCZ

2.11.9.68 Overall for the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF of the West of Walney MCZ, the magnitude of the impact is **no change** and the sensitivity of the receptor is **negligible** to **high**. There will, therefore, be **no effect** on the IEFs of the West of Walney MCZ.

West of Copeland MCZ

2.11.9.69 Overall for the subtidal sand IEF, the subtidal mixed sediment IEF and the subtidal coarse sediment IEF of the West of Copeland MCZ, the magnitude of the impact is **no change** and the sensitivity of the receptor is **negligible**. There will, therefore, be **no effect** on the IEFs of the West of Copeland MCZ.

Intertidal habitat IEFs

2.11.9.70 Overall, for the species poor/barren sands IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant.

2.11.9.71 Overall, for the polychaete/bivalve-dominated muddy sand shores IEF, the sensitivity of the receptor is **medium** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that this IEF is adapted for.

Decommissioning phase

2.11.9.72 The MDS assumes that cable protection may be left *in situ* post decommissioning and that changes in physical processes may persist beyond the lifetime of the Transmission Assets.

2.11.9.73 As detailed in commitment CoT108 and CoT109 (**Table 2.11**), all external cable protection used within the Fylde MCZ will be designed to be removable on decommissioning with the requirement for removal agreed with stakeholders and regulators at the time of decommissioning. Therefore changes to physical processes as a result of the presence of infrastructure within the Fylde MCZ will not persist beyond the decommissioning phase and so has not been assessed further.

Sensitivity of receptor

Subtidal habitat IEFs

2.11.9.74 The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**.

2.11.9.75 The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**.

2.11.9.76 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**.

2.11.9.77 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore considered to be **high** (reduced to **medium** in absence of seapens).

2.11.9.78 The brittlestar beds IEF is deemed to be of low vulnerability, high recoverability, and national value. The sensitivity of the receptor is **negligible**.

2.11.9.79 The low resemblance stony reef IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**.

Shell Flat and Lune Deep SAC

2.11.9.80 The sandbanks which are slightly covered by sea water IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

2.11.9.81 The reef IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

West of Walney MCZ

2.11.9.82 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore considered to be **high** (reduced to **medium** in absence of seapens).

2.11.9.83 The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

2.11.9.84 The subtidal mud IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

West of Copeland MCZ

2.11.9.85 The subtidal coarse sediment IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

2.11.9.86 The subtidal mixed sediment IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

2.11.9.87 The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

Intertidal habitat IEFs

2.11.9.88 The species poor/barren sands IEF is deemed to be of low vulnerability, recoverability and national value. The sensitivity of the receptor is **negligible**.

2.11.9.89 The polychaete/bivalve-dominated muddy sand shores IEF is deemed to be of low to negligible vulnerability and medium recoverability and national value. The sensitivity of the receptor is considered to be **medium**.

2.11.9.90 The *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is deemed to be of low vulnerability, recoverability and national value. The sensitivity of the receptor is **negligible**.

Magnitude of receptor

Subtidal habitat IEFs

2.11.9.91 Following decommissioning, changes to tidal and wave regime as well as the sediment transport and sediment pathways would be of a similar magnitude to those in the operation and maintenance phase with cable protection within the context of the MDS.

2.11.9.92 The impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility. The magnitude is therefore **low**.

Shell Flat and Lune Deep SAC

2.11.9.93 As the cable protection will remain *in situ* and continue to influence the tidal regime, any changes will be approximately equal to that caused during the operation and maintenance phase, as detailed in **paragraphs 2.11.9.50** to **2.11.9.51**.

2.11.9.94 Given the distance of the SAC from the Transmission Assets, the impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility. The magnitude is therefore **no change**. This is due to the lack of overlap with the Transmission Assets, or the predicted 5 km sediment plume.

West of Walney MCZ

2.11.9.95 As the cable protection will remain *in situ* and continue to influence the tidal regime, any changes will be approximately equal to that caused during the operation and maintenance phase, as detailed in **paragraphs 2.11.9.54** to **2.11.9.55**.

2.11.9.96 The impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility. The magnitude is therefore **no change**.

West of Copeland MCZ

2.11.9.97 As the cable protection will remain *in situ* and continue to influence the tidal regime, any changes will be approximately equal to that caused during the operation and maintenance phase, as detailed in **paragraphs 2.11.9.56** to **2.11.9.57**.

2.11.9.98 The impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility. The magnitude is therefore **no change**.

Intertidal habitats IEFs

2.11.9.99 As the cable protection will remain *in situ* and continue to influence the tidal regime, any changes will be approximately equal to that caused during the operation and maintenance phase, as detailed in **paragraphs 2.11.9.58** to **2.11.9.62**.

2.11.9.100 The impact is predicted to be of local spatial extent and long term duration. The magnitude is therefore **negligible**.

Significance of receptor

Subtidal habitat IEFs

2.11.9.101 Overall, for most of the subtidal IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal muddy sands with relatively species poor benthic communities IEF, subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, low resemblance stony reef IEF and the brittlestar beds IEF and) the sensitivity of the receptor is **negligible** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for.

2.11.9.102 Overall, for the seapens and burrowing megafauna communities IEF, the sensitivity is high, reduced to **medium** due to the absence of seapens, and the magnitude of the impact is **low**. The effect will, therefore, be of **minor** adverse significance, which is not significant.

Shell Flat and Lune Deep SAC

2.11.9.103 Overall, for the sandbanks which are slightly covered by sea water all the time and reef IEFs of the Shell Flat and Lune Deep SAC, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **no change**. There will, therefore, be **no effect** on the IEFs of the Shell Flat and Lune Deep SAC.

West of Walney MCZ

2.11.9.104 Overall, for the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF of the West of Walney MCZ, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **no change**. The effect will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets.

West of Copeland MCZ

2.11.9.105 Overall, for the subtidal sand IEF, the subtidal mixed sediment IEF and the subtidal coarse sediment IEF of the West of Copeland MCZ the sensitivity of the receptor is **negligible** and the magnitude of the impact is **no change**. There will, therefore, be **no effect** on the IEFs of the West of Copeland MCZ. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets.

Intertidal habitats IEFs

2.11.9.106 Overall, for the species poor/barren sands IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF, the sensitivity of the receptor is **negligible** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant.

2.11.9.107 Overall, for the polychaete/bivalve-dominated muddy sand shores IEF, the sensitivity of the receptor is **medium** and magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that this IEF is adapted for.

2.11.10 Impact to benthic invertebrates due to electromagnetic fields

2.11.10.1 The presence and operation of export cables within the Transmission Assets may lead to localised EMF affecting benthic subtidal and intertidal receptors during the operation and maintenance phase.

2.11.10.2 The benchmark for the relevant MarESA pressure which has been used to inform this impact assessment is:

- electromagnetic changes: Local electric field of 1 V/m. Local magnetic field of 10 µT. Localised electric and magnetic fields associated with operational power cables. Such cables may generate electric and magnetic fields that could alter the behaviour and migration patterns of sensitive species.

Operation and maintenance phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.10.3 The MarESA sensitivity assessments do not consider there to be sufficient evidence to support sensitivity classification of benthic subtidal habitats to changes in EMF for any of the specified IEFs. The assessment presented is therefore qualitative and based on the current, limited, knowledge on the sensitivity of benthic species to EMF. It should be noted that effects of EMF on mobile and/or commercial important shellfish species are fully assessed in Volume 2, Chapter 3: Fish and shellfish ecology of the ES.

2.11.10.4 Gill and Desender (2020) summarised current research on the impact of EMF emissions on organisms and acknowledged that relatively little is known about the effects of EMF on invertebrates such as those common in benthic communities. This is supported by a recent evaluation of knowledge of the impacts of EMF on invertebrates which concluded, globally, no direct impact on survival has been identified in the literature (Hervé, 2021), with this reflected in the lack of evidence available for the MarESA process for all subtidal habitat IEFs. Furthermore, the methods to assess benthic invertebrates are variable therefore creating the same variability in results, as well as, in some cases, contradiction (Hutchinson *et al*., 2020). Some studies found that benthic communities which grow along cable routes were generally similar to those in the nearby area (Gill and Desender, 2020). These communities however are not exposed to the maximum EMF emissions due to cable burial creating a physical distance between the cable and the seabed surface. The EMF which reaches the surface however is measurable at biologically relevant scales at the seabed and in the water column (Hutchinson *et al*., 2020). Although whether these levels are detectable by benthic species is a topic of research.

2.11.10.5 Experimental evidence has demonstrated that exposure to EMF did not change the distribution of the ragworm *H. diversicolor* however more vertical migration was associated with conditions where ragworms were exposed to a magnetic field (Jakubowska *et al*., 2019). Stankevičiūtė *et al*. (2019) obtained similar results with *H. diversicolor* and Baltic clam *Limecola balthica* after 12 days under an alternating field (i.e., 50 Hz, from 0.85 to 1.05 mT). Other experiments have however demonstrated magnetoreception in marine molluscs and arthropods and biogenic magnetite has been known to occur in marine molluscs for over five decades (Normandeau, 2011). Bochert and Zettler (2004), examined the effects of magnetic fields on the survival rates of various marine invertebrates including blue mussel *M. edulis* and identified no changes in the survival rates after long-term exposure to 3.7 mT static fields.

2.11.10.6 Magneto-receptive and electro-receptive species have evolved to respond to small changes in the Earth's geomagnetic fields and bioelectric fields making the presence of an EMF more perceivable to receptive species (Hutchinson *et al*., 2020). Reported sensitivities to electric fields for invertebrates range from around 3 millivolts per metre (mV/cm) to 20 mV/cm (Steullet *et al*., 2007). Research conducted on the edible crab *Cancer pagurus* by Scott *et al*. (2021) found that EMF strength of 250 microteslas (μT) had limited physiological and behavioural impacts, far above levels expected to be generated from cables from the Transmission Assets. Exposure to 500 μT and 1,000 μT were found to disrupt internal stress response and crabs showed a clear attraction to EMF exposed (500 μT and 1000 μT) shelters with a significant reduction in time spent roaming (Scott *et al*., 2021).

2.11.10.7 Further research by Harsanyi *et al*. (2022) examined the effect of EMF on crab *C. pagurus* and lobster *Homarus sp.* early development, which are not considered as benthic IEFs but are highly dependent on benthic environments during most life stages. Chronic exposure to 2.8 millitesla (mT) EMF throughout embryonic development resulted in significant differences in stage-specific egg volume and resulted in stage I lobster and zoea I crab larvae exhibiting decreased carapace height, total length, and maximum eye diameter. These traits may ultimately affect larval mortality, recruitment and dispersal. The levels of EMF exposure which is simulated by Harsanyi *et al*. (2022) is likely to only be found directly above and a few meters either side of the cable reducing the area this impact could occur over. Normandeau (2011) summarised that, despite these sensitivities, no direct evidence of impacts to invertebrates from undersea cable EMFs exists, with any significant impact likely only being present in species with specific electric and magnetic sense receptors.

2.11.10.8 The conclusion that the impact of EMF is negligible is popular amongst the international community. For example in Germany, the Federal Maritime and Hydrographic Agency stated in its guidance on the design of offshore wind turbines that the expected magnetic field produced by a submarine power cable will be well below the geomagnetic field on the surface, and the effect therefore assumed to be negligible (Olsson *et al*., 2010). Similar conclusions have been drawn in Sweden and Norway (Olsson *et al*., 2010).

2.11.10.9 The current literature suggests that EMF-influenced behavioural and physiological effects in benthic invertebrates, if any are observed, will be closely related to the proximity of the individual to the source and only during operation with recoverability therefore not applicable to this impact. Despite this, and due to the low confidence in the assessment of sensitivity due to a lack of data, a precautionary approach has been taken to determine the sensitivity below.

2.11.10.10 The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.10.11 The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.10.12 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.10.13 The seapens and burrowing megafauna communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.10.14 The brittlestar beds IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

Fylde MCZ

2.11.10.15 Both the subtidal sand and subtidal mud communities are characterised by polychaetes, echinoderms and bivalves. The sensitivity of IEFs within the Fylde MCZ is therefore as described in **paragraphs 2.11.10.3** to **2.11.10.9** for the subtidal habitat IEFs.

2.11.10.16 Based on this information it is difficult to come to a conclusion in relation to the vulnerability of these communities however the recoverability of the community is likely to be high considering the small area likely to be affected by this impact which is detailed below in **paragraph 2.11.10.30**, allowing the surrounding unimpacted habitat to support these potentially impacted areas. A precautionary approach has therefore been taken to determine the sensitivity below.

2.11.10.17 The subtidal sand IEF of the Fylde MCZ is deemed to be of medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

2.11.10.18 The subtidal mud IEF of the Fylde MCZ is deemed to be of medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

Intertidal habitat IEFs

2.11.10.19 As discussed in **paragraph 2.11.10.3**, the MarESA sensitivity assessments do not consider there to be sufficient evidence to support sensitivity classification of benthic intertidal habitats to changes in EMF. It would be expected that the species poor/barren sands IEF would have no sensitivity to this impact.

2.11.10.20 Experimental evidence has demonstrated that exposure to EMF did not change the distribution of the ragworm *H. diversicolor* (Jakubowska *et al*., 2019), with this suggesting low to no sensitivity of ragworm species in intertidal habitats, although more research is again required. As lack of evidence does not denote a lack of impact, a precautionary approach to the sensitivity assessment has been adopted, although the relatively small intertidal area and the burial of cables will likely reduce the potential impacts significantly.

2.11.10.21 The species poor/barren sands IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.10.22 The polychaete/bivalve-dominated muddy sand shores IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.10.23 The *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

Magnitude of impact

Subtidal and intertidal habitat IEFs

2.11.10.24 EMF comprise both the electrical fields, measured in V/m, and the magnetic fields, measured in μT or milligauss (mG). Background measurements of the magnetic field are approximately 50 μT for example in Ireland (EIR grid group, 2015). It is common practice to block the direct electrical field using conductive sheathing, meaning that the only EMFs that are emitted into the marine environment are the magnetic field and the resultant induced electrical field. It is generally considered impractical to assume that cables can be buried at depths that will reduce the magnitude of the magnetic field, and hence the sediment-sea water interface induced electrical field, to below that at which these fields could be detected by certain marine organisms on or close to the seabed (Gill *et al*., 2005; Gill *et al*., 2009). By burying a cable, the magnetic field at the seabed is reduced due to the distance between the cable and the seabed surface as a result of field decay with distance from the cable (CSA, 2019). The magnetic field is about

10 µT/m with a cable that is buried 1.5 m down in the sea floor (Hutchison *et al*., 2021).

2.11.10.25 A variety of design and installation factors affect EMF levels in the vicinity of the cables. These include current flow, distance between cables, cable insulation, number of conductors, configuration of cable and burial depth. The flow of electricity associated with an alternating current (AC) cable (proposed for all export cables associated with the Transmission Assets; see **Table 2.12**) changes direction (as per the frequency of the AC transmission) and creates a constantly varying electric field in the surrounding marine environment (Huang, 2005).

2.11.10.26 The strength of the magnetic field (and consequently, induced electrical fields) decreases rapidly horizontally and vertically with distance from source. A recent study conducted by CSA (2019) found that the burial of export cables to depths of 1 m to 2 m reduces the magnetic field at the seabed surface four-fold. For cables that are unburied and instead protected by thick concrete mattresses or rock berms, the field levels were found to be similar to buried cables.

2.11.10.27 CSA (2019) investigated the relationship between voltage, current, and burial depth, the results of which are presented in **Table 2.22** which shows the magnetic and induced electric field levels expected directly over the undersea power cables and at distance from the export cables. Directly above the cable, EMF levels decrease with increasing distance from the seafloor to 1 m above the cable, while with lateral movement away from the cable, at distances greater than 3 m, the magnetic fields at the seafloor and at 1 m above the seafloor are comparable.

Table 2.22: Typical EMF levels over AC undersea power cables from offshore wind energy projects (CSA, 2019)

Power cable type	Magnetic field levels (mT)			
	Directly above cable		3-7.5 m laterally away from cable	
	1 m above cable	At seafloor	1 m above seafloor	At seafloor
Export	0.001 to 0.004	0.002 to 0.0165	<0.00001 to 0.0012	0.0001 to 0.0015
Power cable type	**Induced field levels (mT)**			
	Directly above cable		**3-7.5 m laterally away from cable**	
	1 m above cable	At seafloor	1 m above seafloor	At seafloor
Export	0.00002 to 0.0002	0.00019 to 0.00037	0.000002 to 1.1	0.000004 to 0.00013

2.11.10.28 During the operation and maintenance phase of the Transmission Assets, there will be up to 484 km of 220 or 275 kV HVAC export cables. The minimum burial depth for cables will be 0.5 m (the greater the burial depth, the more the EMF is attenuated, see **Table 2.12**).

2.11.10.29 The impact is predicted to be of local spatial extent and long-term duration. The magnitude is therefore **low**.

Fylde MCZ

2.11.10.30 There may be up to 88 km of 220 or 275 kV HVAC export cables which will be buried at a minimum depth of 0.5 m within the Fylde MCZ during the operation and maintenance phase The magnitude of this impact will be the same as described in **paragraphs 2.11.10.24** to **2.11.10.29**.

2.11.10.31 The impact is predicted to be of local spatial extent and long-term duration for both the features of the Fylde MCZ. The magnitude is therefore **low**.

Significance of effect

Subtidal habitat IEFs

2.11.10.32 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the seapens and burrowing megafauna IEF and the brittlestar beds IEF the sensitivity of the receptor is **low** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** significance, which is not significant. This conclusion is based on the burial of cables to a minimum of 0.5 m where practical, and the use of cable protection otherwise minimising the area of seabed which will be directly impacted by the EMFs surrounding operational cables.

Fylde MCZ

2.11.10.33 Overall, for the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ, the sensitivity of the receptor is **low** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** significance, which is not significant. This conclusion is based on the burial of the cables to 0.5 m depth where practical and the use of cable protection otherwise minimising the overall area of seabed impacted by EMFs surrounding operation cables, and the area of overlap between the Fylde MCZ and the Transmission Assets being relatively small compared to the wider study area.

2.11.10.34 The effects of EMFs on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference: E4).

Intertidal habitat IEFs

2.11.10.35 Overall, for the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **low**. The effect will, therefore, be of **negligible** adverse significance, which is not significant. This conclusion is based on the burial of cables and the highly localised nature of the effects.

2.11.11 Heat from subsea electrical cables

2.11.11.1 The presence and operation of export cables within the Transmission Assets may lead to localised heating of seabed affecting benthic subtidal receptors during the operation and maintenance phase.

2.11.11.2 The benchmark for the relevant MarESA pressure which has been used to inform this impact assessment is:

- temperature increase (local): An increase of 5 °C for one month, or 2 °C for one year.

Operation and maintenance phase

Sensitivity of receptor

Subtidal habitat IEFs

2.11.11.3 The presence of the Transmission Assets infrastructure will result in the generation of heat from subsea electrical cables. The sensitivities of the subtidal habitat IEFs to the identified MarESA pressures are presented in **Table 2.23**. For all biotopes there was little evidence available to assess the relevant MarESA pressure of temperature increase (local) which has a benchmark of an increase in 5 °C for one month, or 2 °C for one year.

2.11.11.4 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF are presented in **Table 2.23** range from not sensitive to low, based on the thermal limits of their characteristic benthic species (Davenport and Davenport, 2005). Many polychaete species characteristic of these IEFs including *Mediomastus fragilis*, *O. fusiformis* and *Protodorvillea kefersteini* recruit in spring/early summer recruitment (Sardá *et al*., 1999). Also, the characterising bivalve *K. bidentata* was recorded in Kinsale Harbour in Ireland at temperatures ranging from 7.7-18.8 °C (O'Brien and Keegan, 2006), with growth determined by temperature (Künitzer, 1989), but it is unlikely temperature increases from cables will significantly impact this. As the sediment temperature change expected in relation to the presence of cables is anticipated to be minimal and within the thermal range of species residing in UK waters it is unlikely that there will be any notable effects on the characteristic species and therefore the biotopes broadly.

2.11.11.5 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF range between not sensitive to low. The characterising species of the SS.SMu.CSaMu.AfilKurAnit biotope are widely distributed and likely to occur both north and south of the British Isles, where typical surface water temperatures vary seasonally from 4-19 °C (Huthnance, 2010), with these species therefore having no sensitivity to local temperature changes. The sensitivity of the component biotope is low, with elevated temperatures potentially affecting growth of some of the characterising species, but no mortality is expected (De-Bastos and Hill, 2023a). It is therefore likely that *L. koreni* and *P. pellucidus* are able to resist a long-term increase in temperature of 2 °C (De-Bastos, 2023a) which is well within the potential temperature rise which may result from offshore subsea cables.

2.11.11.6 The seapens and burrowing megafauna communities IEF has a medium sensitivity to local temperature increase primarily due to the slow recovery rate of the habitat. Some species of seapen as well as the accompanying burrowing megafauna are buffered from temperature increases typically due to their burrowing lifestyle (Hill *et al*., 2023). *V. mirabilis* are recorded across very different environmental conditions, including west Europe, the Mediterranean, Norway, Iceland, north Africa, and the Gulf of Mexico (OBIS, 2016). The distribution of seapens suggests that they are probably resistant to a 2°C change in temperature (which is likely to be greater than the temperature change which may be caused by buried subsea cables associated with the Transmission Assets) (Hill *et al*., 2023). Although the seapen species *V. mirabilis* or *P. phosphorea* were not recorded within the Offshore Order Limits, a precautionary approach has been applied and therefore the sensitivity of this IEF is medium.

2.11.11.7 *Ophiothrix fragilis* is widely distributed in the east Atlantic from Norway to South Africa and *Ophiocomina nigra* from Norway to the Azores and Mediterranean (Hayward and Ryland, 1995). Other component species in the biotope also have a widespread distribution in the north east Atlantic. Consequently, these species are exposed to temperatures both above and below those found in the British Isles and their distribution is not limited by temperature. Short-term acute changes in temperature are noted to cause a reduction in the loading of subcutaneous symbiotic bacteria in echinoderms such as *Ophiothrix fragilis*. Reductions in these bacteria are probably indicative of levels of stress and may lead to mortality (Newton and McKenzie, 1995), but the potential temperature increases from the cables is unlikely to be beyond the natural temperature range of these species.

2.11.11.8 The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.11.9 The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.11.10 The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **low**.

2.11.11.11 The seapens and burrowing megafauna communities IEF is deemed to be of medium vulnerability, medium recoverability and national value. The sensitivity of the receptor is **medium**.

2.11.11.12 The brittlestar beds IEF is deemed to be of low vulnerability, high recovery, and national value. The sensitivity of the receptor is **negligible**.

Fylde MCZ

2.11.11.13 The presence of the Transmission Assets infrastructure will result in the generation of heat from subsea electrical cables. The sensitivities of the Fylde MCZ IEFs to the identified MarESA pressures are presented in **Table 2.23**.

2.11.11.14 Two of the component biotopes of the subtidal sand IEF (SS.SCS.ICS.MoeVen and SS.SSa.CMuSa.AalbNuc) have been recorded in the Mediterranean (Tillin, 2022; Tillin and Budd, 2023). Therefore they are likely to regularly experience temperatures higher than those produced in the UK, making it unlikely that they will be adversely impacted by the comparatively small and localised temperature increases associated with subsea electrical cables indicating a low vulnerability and high resistance to this impact. An acute change however may exceed thermal tolerances or lead to spawning or other biological effects (Tillin, 2022; Tillin and Budd, 2023). An acute temperature is highly unlikely to result from buried export cables (further detail provided in **paragraphs 2.11.11.3** to **2.11.11.5**). A similar assessment is made for the SS.SCS.ICS.Glap as although the biotope as a whole doesn’t appear in warmer climates, many of the characterising species do (Tillin, 2023a). It is therefore unlikely that they will be adversely impacted by the comparatively small temperature increase associated with subsea electrical cables.

2.11.11.15 Key species of the component biotopes of the subtidal mud IEF (e.g. *A. filiformis*) has have found to experience annual variations in temperature of about 10 °C in Galway Bay where they occur in dense aggregations (Connor *et al*., 1983). Elevated temperatures may affect growth of some of the characterising species of the component SS.SMu.CSaMu.AfilKurAnit biotope, but no mortality is expected indicating a low vulnerability. It is therefore likely that the characterising species are able to resist a long-term increase in temperature of 2 °C which is on the higher end of what they may experience as a result of operational subsea electrical cables. *E. cordatum*, one of the characterising species of the SS.SSa.IMuSa.EcorEns biotope, is found from Norway to South Africa, Mediterranean, Australasia and Japan, and *E. ensis* is widely distributed in the north west of Europe as is *L. Koreni*. Species associated with the SS.SSa.IMuSa.EcorEns biotope are therefore likely to experience seasonal changes in water temperatures by as much as 10 °C from summer to winter, although growth and fecundity could probably be affected (De-Bastos and Hill, 2023b). It is likely that *L. koreni* and *P. pellucidus* are able to resist a long-term increase in temperature of 2 °C and potentially benefit from increased feeding activity and recruitment opportunities. However, based on Schückel *et al*. (2010), an acute 5 °C increase for one month period may result in some mortality, this is however beyond the possible impact associated with the Transmission Assets subsea cables.

2.11.11.16 The subtidal sand IEF and subtidal mud IEF of the Fylde MCZ are deemed to be of medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

Table 2.23: Sensitivity of the benthic subtidal habitat IEFs and the broadscale habitat features of Fylde MCZ to heat from subsea electrical cables

IEF	Representative biotopes	Sensitivity to defined MarESA pressure	Overall sensitivity (based on Table 2.14)
		Temperature increase (local)	
Subtidal habitats			
Subtidal coarse and mixed sediments with diverse benthic communities	SS.SCS.CCS SS.SMx.OMx SS.SMx.OMx.PoVen	Low	Low
	SS.SMx.CMx.KurThyMx	Low	
Subtidal muddy sands with relatively species poor benthic communities	SS.SMu.CMuSa SS.SMu.CSaMu.LkorPpel	Low	Low
	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	
Subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities.	Subtidal sandy sediments characterised by echinoderms, polychaetes and bivalves SS.SSa.IFiSa SS.SSa.CFiSa SS.SSa.CFiSa.EpusOborApri	Low	Low
	SS.SSa.CMuSa.AalbNuc	Low	
	SS.SSa.CFiSa.ApriBatPo	Low	
Seapens and burrowing megafauna communities	SS.SMu.CFiMu.SpnMeg	Medium	Medium
Brittlestar beds	SS.SMx.CMx.OphMx	Not sensitive	Negligible
Broadscale habitats: features of MCZs			
Subtidal mud	SS.SMu.CSaMu.AfilKurAnit SS.SSa.CMuSa	Not sensitive	Low
	SS.SSa.IMuSa.EcorEns	Not sensitive	
	SS.SMu.CSaMu.LkorPpel	Low	

IEF	Representative biotopes	Sensitivity to defined MarESA pressure Temperature increase (local)	Overall sensitivity (based on Table 2.14)
Subtidal sand	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	Low
	SS.SCS.ICS.Glap	Not sensitive	
	SS.SCS.ICS.MoeVen	Low	
	SS.SSa.CMuSa.AalbNuc	Low	
	SS.SMx.CMx.KurThyMx	Low	

Magnitude of impact

Subtidal habitat IEFs

2.11.11.17 Submarine power cables such as those to be installed for the Transmission Assets generate heat through resistive heating. It is caused by energy loss as electrical currents flow and leads to the heating of the cable surface and the warming of the surrounding environment. High voltage cables are used to minimise the amount of energy lost as heat which in turn minimises the environmental warming effect.

2.11.11.18 Where submarine power cables are buried, the surrounding sediment may be heated. The cables, however, have negligible capability to heat the overlying water column because of the very high heat capacity of water (the amount of energy needed to result in a temperature change). There is little research on the heat dissipation effect resulting from subsea cables in the field as well as its effect on benthic receptors. Meißner *et al*. (2007) conducted a field study at Nysted Offshore Wind Farm in Denmark. This study tested the difference in sediment temperature between a control site and a site 25 cm away from the cable. Results showed a 2^{o}C maximum difference between sites with a mean difference of 1^{o}C, with similar results for a HVAC 33 kV cable and HVAC 132 kV cable (low and high voltage cables respectively).

2.11.11.19 Additionally, the impact of seabed temperature rise as a result of buried cables has been considered during a project to bury a submarine High Voltage Direct Current cable between New England and Long Island, New York. The project estimated that the rise in temperature at the seabed immediately above the buried cable to be just 0.19^{o}C (BERR, 2008). The seasonal temperature range in the Irish Sea is 11^{o}C – 5^{o}C (Howarth, 2004), therefore any change similar to those observed by the previously described studies would fall within the natural seasonal variation of this region. Furthermore, the effects of climate change are likely to result in higher average temperatures being the norm.

2.11.11.20 A number of environmental factors have been identified which change the way that heat from subsea cables will dissipate, such as the nature of sediment that the cable is buried in. A lab-based study by Emeana *et al*. (2016) investigated the thermal regime around high voltage submarine cables using a heat source in a large tank to simulate seafloor conditions. The research Identified that when the heat source was buried in fine clay/silt sediments it had a conductive heat transfer mode, only raising temperatures in the immediate radius of the cable. When the heat source was buried in fine permeable sand, they observed convective heat transfer when the heat sources surface temperature reached over 20ºC above the ambient temperature resulting in temperature change up to 1 m above the heat sources surface (when the heat source was buried at 1 m). In coarse sands convection occurred at a lower temperature (>9ºC) and increases in fluid temp were detectable over 1 m above the heat sources surface. This study however was conducted in a laboratory without the influence of water flow which, in an offshore environment, would quickly dissipate the effects of heat emissions (Worzyk, 2009).

2.11.11.21 During the operation and maintenance phase of the Transmission Assets, there will be up to 484 km of 220 to 275 kV HVAC cables. The minimum burial depth for cables will be 0.5 m (see **Table 2.12**).

2.11.11.22 The impact is predicted to be of local spatial extent and long-term duration. The magnitude is therefore **negligible**.

Fylde MCZ

2.11.11.23 Based on the proportion of the Fylde MCZ which overlaps with the Transmission Assets Offshore export cable corridor, the MDS assumes that there may be up to 88 km of 220 to 275 kV HVAC export cables which will be buried at a minimum depth of 0.5 m within the MCZ.

2.11.11.24 The magnitude of the impact on benthic invertebrates due to heat from subsea cables is consistent across the Transmission Assets including in the sections which overlap with the Fylde MCZ and is, therefore, as outlined in **paragraphs 2.11.11.17** to **2.11.11.21**.

2.11.11.25 The impact is predicted to be of local spatial extent and long-term duration for both the features of the Fylde MCZ. The magnitude is therefore **negligible**.

Significance of effect

Subtidal habitat IEFs

2.11.11.26 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF and the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the sensitivity of the receptor is **low** and the magnitude of the impact is **negligible**. The effect will, therefore, be of **negligible** significance, which is not significant. This significance has been determined due to the highly localised and very low levels of heat which are expected from the cables, creating conditions well within the natural variability experienced by the characteristic communities of these IEFs.

2.11.11.27 Overall, for the seapens and burrowing megafauna communities IEF the sensitivity of the receptor is **medium** and the magnitude is **negligible**. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This significance has been determined due to the highly localised and very low levels of heat which are expected from the cables, creating conditions well within the natural variability experienced by the characteristic species of this IEF.

2.11.11.28 Overall, for the brittlestar beds IEF, the sensitivity of the receptor is **negligible** and the magnitude is deemed **negligible**. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

Fylde MCZ

2.11.11.29 Overall for the subtidal sand IEF and subtidal mud IEF of the Fylde MCZ, the magnitude of the impact is **negligible** and the sensitivity of the receptor is **low**. The effect will, therefore, be of **negligible** significance, which is not significant. This significance has been determined due to the highly localised and very low levels of heat which are expected from the cables, creating conditions well within the natural variability experienced by the characteristic communities of these IEFs.

2.11.11.30 The effects of heat from subsea electrical cables on the designated features of the Fylde MCZ are also fully considered within the Transmission Assets MCZ Stage 1 Assessment (document reference: E4).

2.11.12 Future monitoring

2.11.12.1 **Table 2.24** below outlines the proposed monitoring commitments, which are detailed in Volume 1, Annex 5.3: Commitments Register of the ES.

Table 2.24: Monitoring commitments

Commitment number	Measure adopted	How the measure will be secured
CoT115	An OIPMP has been prepared and submitted as part of the application for development consent. The OIPMP includes for monitoring of the recovery of sediments and benthic communities within representative areas of the Fylde MCZ potentially impacted by sandwave clearance, cable installation and cable protection, at appropriate temporal intervals as part of the operational asset integrity surveys. Detailed Offshore Monitoring Plans will be produced prior to operation and maintenance phases in accordance with the OIPMP and will be approved in consultation with statutory advisors and regulators.	DCO Schedule 14 (Marine Licence 1: Morgan Offshore Wind Project Transmission Assets) Part 2 – Condition 18(1)(d) (Pre-construction plans and documentation) and DCO Schedule 15 (Marine Licence 2: Morecambe Offshore Wind Farm Transmission Assets), Part 2 - Condition18(1)(d) (Pre-construction plans and documentation).

2.12 Cumulative effect assessment methodology

2.12.1 Introduction

2.12.1.1 The CEA takes into account the impact associated with the Transmission Assets together with other projects and plans. The projects and plans selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise (see Volume 1, Annex 5.5: Cumulative screening matrix and location plan of the ES). Each project has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

2.12.1.2 The cumulative assessment has been undertaken as follows.

- Scenario 1: Transmission Assets together with Morecambe Offshore Windfarm: Generation Assets.
- Scenario 2: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets.
- Scenario 3: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets.
- Scenario 4: Scenario 3 together with Tier 1, Tier 2 and Tier 3 projects, plans and activities, defined as follows.
  - Scenario 4a: Scenario 3 and Tier 1 projects, plans and activities which are:
    - under construction;
    - permitted application;
    - submitted application; or
    - those currently operational that were not operational when baseline data were collected, and/or those that are operational but have an ongoing impact.
  - Scenario 4b: Scenario 4a and Tier 2 projects, plans and activities which a:
    - Scoping Report has been submitted in the public domain.
  - Scenario 4c: Scenario 4b and Tier 3 projects, plans and activities which are:
    - where a Scoping Report has not been submitted and it is not in the public domain;
    - identified in the relevant Development Plan; or
    - identified in other plans and programmes.

2.12.1.3 This tiered approach is adopted to provide a clear assessment of the Transmission Assets alongside other projects, plans and activities.

2.12.1.4 The specific projects, plans and activities scoped into the CEA, are outlined in **Table 2.25** and shown in Figure 2.7 in Volume 2, Figures.

Table 2.25: List of other projects, plans and activities considered within the CEA

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
Transmission Assets	-	-	-	2027 to 2030	2030 to 2065	-
Morecambe Offshore Windfarm: Generation Assets	Submitted	0 km	480 MW Offshore Wind Farm (generating assets)	2026 to 2029	2030 to 2064	The construction, operation and maintenance and decommissioning phases of this project will overlap with the construction, operation and maintenance and decommissioning phases of the Transmission Assets. Considered alongside the Transmission Assets in Scenarios 1, 3, 4a, 4b and 4c.
Morgan Offshore Wind Project: Generation Assets	Submitted	0 km	1.5GW Offshore Wind Farm (generating assets)	2026 to 2030	2030 to 2065	The construction, operation and maintenance and decommissioning phases of this project will overlap with the construction, operation and maintenance and decommissioning phases of the Transmission Assets. Considered alongside the Transmission Assets in Scenarios 2, 3, 4a, 4b and 4c.
Tier 1						
Offshore Renewable Projects						
Walney Extension 3	Operational (with ongoing activities)	5.71	Up to 330 MW capacity	Constructed	2018 to 2039	The operation and maintenance and decommissioning phases of this project will temporally overlap with the construction and operation and

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
Offshore Wind Farm						maintenance phases of the Transmission Assets.
Walney Extension 4 Offshore Wind Farm	Operational (with ongoing activities)	6.05	Up to 329 MW capacity	Constructed	2018 to 2039	The operation and maintenance and decommissioning phases of this project will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
West of Duddon Sands Offshore Wind Farm	Operational (with ongoing activities)	6.47	Up to 389 MW (108 wind turbines)	Constructed	2014 to 2033	The operation and maintenance and decommissioning phases of this project will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
West of Duddon Sands Offshore Wind Farm Operational Marine Licence operations and maintenance activities (MLA/2016/00150/3)	Operational	6.47	Covers licensable operation and maintenance activities to be carried out as and when required over the lifetime of the wind farm.	n/a	2016 to 2037	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
Mona Offshore Wind Project	Submitted	9.73	Offshore wind farm (generating assets, up to 1.5 GW) and offshore export cable	2026 to 2030	2030 to 2065	The construction, operation and maintenance and decommissioning phases of this project will overlap with the construction, operation and

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
			(transmission assets)			maintenance and decommissioning phases of the Transmission Assets.
Walney 2 Offshore Wind Farm	Operational (with ongoing activities)	10.17	Up to 183.6 MW (51 wind turbines)	Constructed	2012 to 2032	The operations and maintenance and decommissioning phases of this project will temporally overlap with the construction and operations and maintenance phases of the Transmission Assets.
Walney 1 and 2 Offshore Wind Farms Operational Marine Licence - operations and maintenance activities (MLA/2016/0015 1/3)	Operational	10.17	Covers licensable operation and maintenance activities to be carried out as and when required over the lifetime of the wind farms.	n/a	2016 to 2032	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
Walney Offshore Wind Farm Operational Marine Licence - inter array cable repair (MLA/2013/0042 6/2)	Operational	10.17	Emergency inter-array cable repairs over the operational life time of the Walney Offshore Wind Farm (1 and 2). To ensure adequate contingency plans are in place to react to a major breakage/fault in	n/a	2018 to 2032	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
			an inter array cable.			
Walney 2 Offshore Wind Farm Operational Marine Licence - composite operations and maintenance activities (MLA/2017/00429/1)	Operational	10.17	Operations and maintenance events including removal of marine growth and/or guano from substation, export cable repair events, with associated anchoring/jacking-up/vessel beaching, remediation events (via jetting and/or mass flow excavator) of up to 7 km length per event, potential jacking-up to and removal and/or replacement of cable/scour protection and deployment of additional cable protection adjacent to existing cable protection to	n/a	2018 to 2038	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
			resolve secondary scour issues.			
Walney 1 Offshore Wind Farm	Operational	11.40	Up to 367 MW (51 wind turbines)	Constructed	2011 to 2032	The operations and maintenance and decommissioning phases of this project will temporally overlap with the construction and operations and maintenance phases of the Transmission Assets.
Walney Offshore Wind Farm Operational Marine Licence - inter array cable repair (MLA/2013/00426/2)	Operational	11.40	A maximum of 10 cable repairs or replacements over the remaining lifetime of the project.	n/a	2018 to 2032	Cable repair/remediation activities associated with this project overlaps with the construction and operations and maintenance phases of the Transmission Assets.
Walney Offshore Wind Farm Operational Marine Licence - phase 2 export cable (MLA/2014/00027/7)	Operational	11.91	Emergency export cable repairs over the operational life time of the Walney Offshore Wind Farm export cables (two) to ensure adequate contingency plans are in place to react to a major breakage/fault within a	n/a	2014 to 2037	These maintenance activities will temporally overlap with the construction phase of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
			reasonable period of time			
Walney Offshore Wind Farm Operational Marine Licence - composite operations and maintenance activities (MLA/2017/0008 1/2)	Operational	15.32	For future cable repair/remediation/ protection works on the Walney 1 export cable and also for potential repair works on the Walney 1 OSP.	n/a	2017 to 2037	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
Walney Offshore Wind Farm Operational Marine Licence - phase 1 export cable (MLA/2014/0002 8/5)	Operational	15.32	Emergency export cable repairs over the operational life time of the Walney Offshore Wind Farm export cables (two) to ensure adequate contingency plans are in place to react to a major breakage/fault in a reasonable period of time.	n/a	2014 to 2037	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
Barrow Offshore Wind Farm	Operational (with ongoing activities)	18.03	Up to 90 MW (30 wind turbines)	Constructed	2006 to 2026	The operations and maintenance and decommissioning phases of this project will temporally overlap with the

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
						construction phase of the Transmission Assets.
Barrow Offshore Wind Farm Operational Marine Licence - operations and maintenance (MLA/2016/00149/3)	Operational	18.03	This licence permits a number of operation and maintenance activities including: - Removal of marine growth and/or guano - Replacement of access ladders - Major component replacement	n/a	2016 to 2026	These maintenance activities will temporally overlap with the construction phase of the Transmission Assets.
Routine operations and maintenance activities at five OSPs (Barrow, Ormonde, Lincs, Westermost Rough, and Gunfleet Sands) (MLA/2017/00100/1)	Operational	19.66	Repainting of offshore structures, removal of algal growth/bird guano and removal of growth around J Tubes.	n/a	2017 to 2038	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
Ormonde Offshore Wind Farm	Operational (with ongoing activities)	20.05	Up to 150 MW (up to 30 wind turbines)	Constructed	2011 to 2036	The operations and maintenance and decommissioning phases of this project will overlap with the construction and operations and

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
						maintenance phases of the Transmission Assets.
Ormonde Offshore Wind Farm Operational Marine Licence–-operations and maintenance activities (MLA/2016/00224/2)	Operational	20.05	Operation and maintenance activities to be carried out as and when required over the lifetime of the wind farm.	n/a	2017 to 2037	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
Ormonde Offshore Wind Farm Operational Marine Licence - export cable repair and remediation (MLA/2015/00086/2)	Operational	20.48	Five cable repair events, with associated jacking-up; and ten cable remediation events (via jetting).	n/a	2015 to 2030	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
Barrow Offshore Wind Farm Operational Marine Licence - export cable repair and remediation (MLA/2015/00077)	Operational	20.52	Five cable repair events, with associated jacking-up; and ten cable remediation events (via jetting).	n/a	2015 to 2030	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
Burbo Bank Extension Offshore Wind Farm	Operational (with ongoing activities)	25.77	Up to 258 MW (32 wind turbines)	Constructed	2017 to 2042	The operations and maintenance and decommissioning phases of this project will temporally overlap with the construction and operations and maintenance phases of the Transmission Assets.
Burbo Bank Offshore Wind Farm Operational Marine Licence – cable repair and remediation (MLA/2014/00336/1)	Operational	26.24	Up to ten discrete array cable repair or remediation events over the lifetime of the wind farm (25 years).	n/a	2018 to 2043	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
Burbo Bank Extension Operational Marine Licence – array cable repair and remediation activities (MLA/2017/00164)	Operational	26.24	Up to ten discrete array cable repair or remediation events over the lifetime of the wind farm (25 years).	n/a	2018 to 2042	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
Burbo Bank Offshore Wind Farm	Operational (with ongoing activities)	26.24	Up to 90 MW (25 wind turbines)	Constructed	2007 to 2032	The operations and maintenance and decommissioning phases of this project will temporally overlap with the construction and operations and maintenance phases of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
Burbo Bank Offshore Wind Farm Operational Marine Licence - export cable repair/remediation activities (MLA/2016/00406)	Operational	26.24	Up to four discrete export cable repair/remediation events over the remaining lifetime of the wind farm (15 years).	n/a	2018 to 2032	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
Burbo Bank Offshore Wind Farm Operational Marine Licence - inter-array cable repair (MLA/2014/00336/1)	Operational	26.24	For works which would be undertaken should any inter array cables at Burbo Bank Offshore Wind Farm fail. A maximum of ten inter-array cable repairs or replacements over the remaining lifetime of the project. This is a pre-emptive application which is designed to limit downtime in any such situation where the cables fail.	n/a	2014 to 2032	These maintenance activities will temporally overlap with the construction and operations and maintenance phases of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
Burbo Bank Extension Operational Marine Licence - export cable repair and remediation activities (MLA/2017/00166/1)	Operational	27.52	Up to four discrete export cable repair or remediation events over the lifetime of the wind farm (25 years).	n/a	2017 to 2042	These maintenance activities will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
Gwynt y Mor Offshore Wind Farm	Operational (with ongoing activities)	28.86	Up to 567 MW (150 to 250 wind turbines), covering up to 90 km^2	Constructed	2011 to 2033	The operation and maintenance and decommissioning phases of this project will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
Awel y Môr Offshore Wind Farm	Consented	28.87	Up to 500 MW (48 to 91 wind turbines)	2026 to 2030	2030 to 2055	The construction, operation and maintenance and decommissioning phases of this project will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
North Hoyle Offshore Wind Farm	Operational (with ongoing activities)	34.20	Up to 150 MW (30 wind turbines)	Constructed	2003 to 2028	The operations and maintenance and decommissioning phases of this project will temporally overlap with the construction and operations and maintenance phases of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
North Hoyle Offshore Wind Farm Operational Marine Licence - operations and maintenance activities	Operational (with ongoing activities)	35.31	Operation and maintenance activities at North Hoyle Offshore Wind Farm. The maintenance operations will take place throughout all assets of the wind farm and will include: Sub sea ROV works, and heavy lifting operations using the a jack up platform.	n/a	2015 to 2029	These maintenance activities will temporally overlap with the construction phase of the Transmission Assets.
Rhyl Flats Offshore Wind Farm Operational Marine Licence - operations and maintenance activities	Operational (with ongoing activities)	39.49	Operation and maintenance including nigh voltage maintenance work and heavy lift work, using jack up vessel.	Constructed	2015 to 2034	These maintenance activities will overlap with the construction and operation and maintenance phases of the Transmission Assets.
Rhyl Flats Offshore Wind Farm	Operational (with ongoing activities)	39.94	Up to 90 MW (25 wind turbines)	Constructed	2002 to 2027	The decommissioning phase of this project will temporally overlap with the construction phase of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
Deposit and removal						
Hilbre Swash (392/393)	Operational (with ongoing activities)	28.54	Licence to extract up to 12 million tonnes of aggregate (mainly sand) over 15 years. Up to 800,000 tonnes per year.	n/a	2015 to 2029	The aggregate extraction activities associated with this site will temporally overlap with the construction phase of the Transmission Assets.
Dredging activities and dredge disposal sites						
Liverpool 2 and River Mersey Approach Channel Dredging	Operational (with ongoing activities)	14.13	Capital dredging in front of the proposed terminal to create a berth pocket.	n/a	2019 to 2028	The dredging activities associated with this site will temporally overlap with the construction phase of the Transmission Assets.
Mersey channel and river maintenance dredge disposal renewal (MLA/2021/00202)	Operational (with ongoing activities)	14.13	The Mersey Docks and Harbour Company Ltd, as the Harbour Authority for the Port of Liverpool has an obligation to dredge the approaches to Liverpool in order to maintain navigation into the	n/a	2021 to 2031	The dredging activities associated with this site will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
			Mersey Estuary for all river users.			
RNLI North Division - Regional Licence for Low Impact Maintenance Works	Operational	14.45	Maintenance activities including minor beach reprofiling at Lytham St. Annes	n/a	2017 to 2027	The maintenance activities associated with this project will overlap with the construction and operations and maintenance phases of the Transmission Assets.
Walney Extension pontoon/jetty dredging and disposal (DC10142)	Operational	20.04	A Marine Licence is being sought for dredging and associated disposal activities for the Walney Extension Offshore Wind Farm operation and maintenance base at the Port of Barrow.	n/a	2019 to 2029	These maintenance activities will temporally overlap with the construction phase of the Transmission Assets.
Douglas Harbour, Isle of Man Dredging Disposal	Operational (with ongoing activities)	22.74	Douglas outer harbour, basin and fairway are plough dredged annually, normally in January/February. The inner harbour/marina is also dredged annually, and silt is	n/a	2016 to 2031	The dredging activities associated with this site will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
			deposited at a licensed site off Douglas Head.			
Port of Barrow maintenance dredging disposal licence (MLA/2015/00458/1)	Operational (with ongoing activities)	23.02	Dredging is required to maintain the Port of Barrow and its approach channel at its advertised navigational depth for all vessels entering and leaving the port and in particular to allow the nuclear powered submarines which are constructed in Barrow to safely leave the port.	n/a	2016 to 2026	The dredging activities associated with this site will temporally overlap with the construction phase of the Transmission Assets.
West of Duddon Sands Pontoon Dredging Marine Licence	Operational	30.31	Maintenance dredging-up to 12,520 m^3. Sedimentation can cause the pontoon edge adjacent to the harbour wall to be raised during spring low tides. The scope of the marine licence	n/a	2018 to 2028	These maintenance activities will temporally overlap with the construction phase of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
			application covers dredging which will be required annually based on the current observed rates of accumulation.			
Annual Maintenance Dredging Peel Harbour Isle of Man	Operational (with ongoing activities)	39.75	Capital harbour dredging, and maintenance dredging. Extracted amount: 400,000 m^3 annually.	n/a	2022 to 2037	The dredging activities associated with this site will overlap with the construction and operation and maintenance phases of the Transmission Assets.
Remedial works						
Isle of Man to UK Interconnector Cable - maintenance and repair (MLA/2016/00211)	Operational	0	This licence is for depositing additional armouring or protection whilst carrying out contingency repair and maintenance works on the Isle of Man interconnector cable. This includes placement of additional armouring or	n/a	2018 to 2033	The maintenance activities associated with this project will overlap with the construction and operation and maintenance phases of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
			protection whilst carrying out contingency repair and maintenance works on the interconnector.			
Isle of Man Interconnector Cable - Cable Protection Remedial Works (MLA/2014/00201)	Operational	0	Maintenance works on the Isle of Man Interconnector cable protection. The installation of flexible filter units, comprising of three bags at two separate locations, but up to a maximum of eight at a cable crossing. Two original concrete mattresses used for cable protection will be removed.	n/a	2014 to 2065	The maintenance activities associated with this project will overlap with the construction and operation and maintenance phases of the Transmission Assets.
Oil and gas infrastructure						
Millom West Platform	Decommissioning	0.49	Millom west field platform proposed for decommissioning. Wells will be	n/a	Decommissioning 2024 to 2030	The decommissioning phase of this project will overlap with the construction and operation and

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
			plugged and cut 3 m below the level of the seabed. Wellheads will be removed and all equipment above the seabed will removed.			maintenance phases of the Transmission Assets.
Isle of Man Crogga Licence (112/25)	Permitted	7.66	Licence for exploratory geotechnical and geophysical surveys as well as exploratory drilling. Block reference 112/25. Within Isle of Man territorial waters. 266 km^2 offshore of the north east coast of the Isle of Man. To drill an appraisal well.	Ending 2025	2026 onwards	The operation and maintenance phase of this project will overlap with the construction and operation and maintenance phase of the Transmission Assets
Tier 2						
Offshore Renewable Projects						
Mooir Vannin Offshore Wind Farm	Pre-application	2.59	Orsted have signed an agreement for lease to develop a 700 MW (annual	2030 to 2032	Operational in 2032 with end date unknown	This project will overlap with the operation and maintenance and decommissioning phases of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
			output 3,000 GWh) wind farm on the east coast and have undertaken initial surveys since 2016.			
Carbon Capture and Storage (CCS)						
Eni Hynet – Carbon Capture Project – offshore	Pre-application (for offshore elements of the project)	5.74	CCS project in the east Irish Sea. Works will include installation of a new cable, a new Douglas CCS platform and work on the existing Hamilton, Hamilton North and Lennox wellhead platforms.	Unknown	Unknown	This project will likely overlap with the construction and operations and maintenance phases of the Transmission Assets.
Deposit and removal						
Liverpool Bay Area 457	Pre-application	2.43	Proposed extraction of 18 Mt of marine aggregate from this site.	n/a	2026 to 2041	The aggregate extraction activities associated with this site will temporally overlap with the construction and operations and maintenance phases of the Transmission Assets.

Project/Plan	Status	Distance from the Offshore Order Limits (nearest point, km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Transmission Assets
Tier 3						
Cables and pipelines						
MaresConnect – Wales-Ireland Interconnector Cable	Pre-application	34.44	A proposed subsea and underground electricity interconnector system linking the existing electricity grids in Ireland and Great Britain.	2025	2027 to 2037	The operation and maintenance and decommissioning phases of this project will temporally overlap with the construction, operation and maintenance phases of the Transmission Assets.
Isle of Man – UK Interconnector 2	Pre-application	N/A	A new 70 MW to 100 MW HVAC interconnector to be operational by 2030 between the Isle of Man and north west England.	2024 to 2030	2030 onwards	The construction, operation and maintenance, and decommissioning phases of this project will temporally overlap with the construction and operation and maintenance phases of the Transmission Assets.
Mooir Vannin - UK Transmission Assets	Pre-application	N/A	Comprising of offshore export cables and a booster station to connect the Mooir Vannin Offshore Wind Farm to the UK.	Unknown	Unknown	The construction and operation and maintenance phases of this project may temporally overlap with the operation and maintenance and decommissioning phases of the Transmission Assets.

2.12.2 Scope of cumulative effects assessment

2.12.2.1 The impacts identified in **Table 2.26** have been selected as those having the potential to result in the greatest cumulative effect on an identified receptor or receptor group. The cumulative effects presented and assessed in this section have been based on the project design envelope set out in Volume 1, Chapter 3: Project Description of the ES as well as the publicly available information available on other projects and plans.

Table 2.26: Scope of assessment of cumulative effects

Cumulative effect	Phase[a] C	Phase[a] O	Phase[a] D	Project(s) considered	Justification
Temporary habitat loss/disturbance	✓	×	×	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets. **Scenario 3** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans. Tier 1 • Offshore Wind Farm projects: – Walney Extension Offshore Wind Farm operations and maintenance phase; – West of Duddon Sands Offshore Wind Farm operation and maintenance phase; – West of Duddon Sands Offshore Wind Farm operations and maintenance licence (MLA/2016/00150/3); – Mona Offshore Wind Project construction phase;	These projects all involve activities which will result in temporary habitat disturbance/loss which may contribute to the impact upon a habitat that the Transmission Assets will also affect.

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				– Walney 2 Offshore Wind Farm operations and maintenance phase; – Walney 1 Offshore Wind Farm operations and maintenance phase; – Walney 1 and 2 Offshore Wind Farms operations and maintenance licences (MLA/2016/00151/3, MLA/2013/00426/2, MLA/2017/00429/1, MLA/2013/00426/2, MLA/2014/00027/7, MLA/2017/00081/2 and MLA/2014/00028/5); – Barrow Offshore Wind Farm operations and maintenance and decommissioning phases; – Barrow Offshore Wind Farm operations and maintenance licence (MLA/2016/00149/3 and MLA/2015/00077); – Routine operations and maintenance activities at five OSPs (Barrow, Ormonde, Lincs, Westermost Rough, and Gunfleet Sands) (MLA/2017/00100/1); – Ormonde Offshore Wind Farm operations and maintenance phase; – Ormonde Offshore Wind Farm operations and maintenance licences (MLA/2016/00224/2 and MLA/2015/00086/2); – Burbo Bank Offshore Wind Farm Extension operation and maintenance phase; – Burbo Bank Offshore Wind Farm operation and maintenance licences (MLA/2014/00336/1, MLA/2016/00406 and MLA/2014/00336/1); – Burbo Bank Offshore Wind Farm Extension operation and maintenance licence (MLA/2017/00164 and MLA/2017/00166/1);	

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				– Burbo Bank Offshore Wind Farm operation and maintenance phase; – Gwynt y Môr Offshore Wind Farm operation and maintenance phase; – Awel y Môr Offshore Wind Farm operation and maintenance phase; – North Hoyle Offshore Wind Farm operation and maintenance phase; – North Hoyle Offshore Wind Farm operation and maintenance licence; – Rhyl Flats Offshore Wind Farm operation and maintenance licence; and – Rhyl Flats Offshore Wind Farm operation and maintenance and decommissioning phase. • Deposit and removal: – Hilbre Swash (392/393). • Dredging projects: – Liverpool 2 and River Mersey approach channel dredging; – Mersey channel and river maintenance dredge disposal renewal; – RNLI North Division - Regional Licence for Low Impact Maintenance Works; – Walney Extension pontoon/jetty dredging and disposal (DC10142); – Douglas Harbour, Isle of Man; – Port of Barrow maintenance dredging disposal licence; – West of Duddon Sands pontoon dredging marine licence; and	

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				– Annual Maintenance Dredging Peel Harbour Isle of Man. • Remedial works: – Isle of Man to UK Interconnector Cable maintenance licences (MLA/2016/00211 and MLA/2014/00201). • Oil and Gas Projects: – Millom West Platform decommissioning phase; and – Isle of Man Crogga licence operation and maintenance phase **Scenario 4b** The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • CCS projects: – ENI Hynet construction and operation and maintenance phase. • Deposit and removal projects: – Liverpool Bay Area 457. **Scenario 4c** The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects. • Cables and pipelines: – MaresConnect construction and operation and maintenance phase; and – Isle of Man Interconnector Cable 2 construction phase.	

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
	✗	✓	✗	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets. **Scenario 3** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans. Tier 1 • Offshore Wind Farm projects: – Walney Extension Offshore Wind Farm operations and maintenance and decommissioning phases; – West of Duddon Sands Offshore Wind Farm operation and maintenance and decommissioning phases; – West of Duddon Sands Offshore Wind Farm operations and maintenance licence (MLA/2016/00150/3); – Mona Offshore Wind Project operation and maintenance phase;	These projects all involve activities which will result in temporary habitat disturbance/loss which may contribute to the impact upon a habitat that the Transmission Assets will also affect.

Cumulative effect	Phase[a] C	O	D	Project(s) considered	Justification
				– Walney 2 Offshore Wind Farm operations and maintenance and decommissioning phases; – Walney 1 Offshore Wind Farm operations and maintenance and decommissioning phases; – Walney 1 and 2 Offshore Wind Farms operations and maintenance licences (MLA/2016/00151/3, MLA/2013/00426/2, MLA/2017/00429/1, MLA/2013/00426/2, MLA/2014/00027/7, MLA/2017/00081/2 and MLA/2014/00028/5); – Routine operations and maintenance activities at five OSPs (Barrow, Ormonde, Lincs, Westermost Rough, and Gunfleet Sands) (MLA/2017/00100/1); – Ormonde Offshore Wind Farm operations and maintenance and decommissioning phases; – Ormonde Offshore Wind Farm operations and maintenance licences (MLA/2016/00224/2 and MLA/2015/00086/2); – Burbo Bank Offshore Wind Farm Extension operation and maintenance and decommissioning phases; – Burbo Bank Offshore Wind Farm operation and maintenance licences (MLA/2014/00336/1, MLA/2016/00406 and MLA/2014/00336/1); – Burbo Bank Offshore Wind Farm Extension operation and maintenance licence (MLA/2017/00164 and MLA/2017/00166/1); – Burbo Bank Offshore Wind Farm operation and maintenance and decommissioning phases; – Gwynt y Môr Offshore Wind Farm operation and maintenance and decommissioning phases;	

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				– Awel y Môr Offshore Wind Farm operation and maintenance and decommissioning phases; and – North Hoyle Offshore Wind Farm operation and maintenance and decommissioning phases. • Dredging projects: – Mersey channel and river maintenance dredge disposal renewal; – Douglas Harbour, Isle of Man; and – Annual maintenance dredging Peel Harbour Isle of Man. • Remedial works: – Isle of Man to UK Interconnector Cable maintenance licences (MLA/2016/00211 and MLA/2014/00201). • Infrastructure: – Millom West Platform; and – Isle of Man Crogga licence. **Scenario 4b** The MDS as described Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • Offshore Wind Farm projects: – Mooir Vannin Offshore Wind Farm operation and maintenance phase. • CCS projects: – Eni Hynet CCS; • Deposit and removal projects:	

Cumulative effect	Phase[a] C	O	D	Project(s) considered	Justification
				– Liverpool Bay Area 457. **Scenario 4c** The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects (Scenario 4b). • Cables/pipelines: – MaresConnect operation and maintenance phase; – Isle of Man – UK Interconnector 2 construction and operation and maintenance phases; and – Mooir Vannin - UK Transmission Assets construction and operation and maintenance phases.	
	✗	✗	✓	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets. **Scenario 3** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets.	These projects all involve activities which will result in temporary habitat disturbance/loss which may contribute to the impact upon a habitat that the Transmission Assets will also affect.

Cumulative effect	Phase[a] C	O	D	Project(s) considered	Justification
				Scenario 4a The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans. Tier 1 • Offshore Wind Farm Projects: – Mona Offshore Wind Project decommissioning phase. **Scenario 4b** The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • Offshore Wind Farm projects: – Mooir Vannin Offshore Wind Farm operation and maintenance phase. **Scenario 4c** The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects (Scenario 4b). • Cables/pipelines: – Mooir Vannin - UK Transmission Assets operation and maintenance phase.	
Increases in SSC and associated deposition	✓	×	×	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets.	Outcome of the CEA will be greatest when the greatest number of other schemes are considered in combination. Including schemes and developments within the

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				Scenario 2 MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets. **Scenario 3** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans. Tier 1 • Offshore wind farm projects: – Maintenance of Walney Extension 4 Offshore Wind Farm; – Maintenance of Walney Extension 3 Offshore Wind Farm; – Maintenance of Walney 2 Offshore Wind Farm; – Maintenance of Walney 1 Offshore Wind Farm; – Maintenance of Walney export and inter array cables; – Maintenance of West of Duddon Sands Offshore Wind Farm; – Maintenance of Barrow Offshore Wind Farm; and – Construction of the Mona Offshore Wind Project. • Dredging activities and dredge disposal sites: – RNLI maintenance activities including beach reprofiling at Lytham St. Annes; – Ribble Estuary dredging and dump at sea; and	CEA study area to capture the potential overlap of impacts during the construction, operation and maintenance and decommissioning phases. Activities from schemes that potentially increase SSCs during the temporal overlap with the Transmission Assets phases have been included as these may create a cumulative impact on physical features/receptors.

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				– Disposal of Douglas Harbour Dredging material at Douglas Head Disposal Site. • Remedial works: – Maintenance/repair of Isle of Man to UK interconnector and replacement of concrete mattresses used for cable protection with rock filled filter units. **Scenario 4b** The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • Offshore wind farm projects: – Proposed development of Mooir Vannin Offshore Wind Farm. • CCS projects: – Proposed development of Eni Hynet – Carbon Capture Project. • Deposit and removal projects: – Operation of the Westminster Gravels Aggregate Extraction site – Liverpool Bay Area 457. **Scenario 4c** The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects (Scenario 4b). • Cables/pipelines: – Construction of the Isle of Man to UK Interconnector Cable 2.	

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
	×	✓	×	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets. **Scenario 3** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans. Tier 1 • Offshore wind farm projects: – Maintenance of Walney Extension 4 Offshore Wind Farm; – Maintenance of Walney Extension 3 Offshore Wind Farm; – Maintenance of Walney 2 Offshore Wind Farm; – Maintenance of Walney 1 Offshore Wind Farm; – Maintenance of Walney export and inter array cables; – Maintenance of West of Duddon Sands Offshore Wind Farm; and – Operation and maintenance of the Mona Offshore Wind Project.	

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				• Dredging activities and dredge disposal sites: – Ribble Estuary dredging and dump at sea. • Remedial works: – Maintenance/repair of Isle of Man to UK interconnector and replacement of concrete mattresses used for cable protection with rock filled filter units. **Scenario 4b** The MDS as described Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • Offshore wind farm projects: – Proposed development of the Mooir Vannin Offshore Wind Farm. • CCS projects: – Proposed development of Eni Hynet – Carbon Capture Project. • Deposit and removal projects: – Operation of the Westminster Gravels Aggregate Extraction site – Liverpool Bay Area 457. **Scenario 4c** The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 2 Projects. • Cables/pipelines:	

Cumulative effect	Phase[a] C	O	D	Project(s) considered	Justification
				– Operation and maintenance of the Isle of Man to UK Interconnector Cable 2; and – Construction and operation and maintenance of the Mooir Vannin - UK Transmission Assets.	
	×	×	✓	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets. **Scenario 3** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans. Tier 1 • Offshore wind farm projects: – Mona Offshore Wind Project decommissioning structures. **Scenario 4b** The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2	

Cumulative effect	Phase[a] C	O	D	Project(s) considered	Justification
				• Tier 1 projects (Scenario 4a). • Offshore wind farm projects: – Proposed development of the Mooir Vannin Offshore Wind Farm. • CCS projects: – Proposed development of Eni Hynet – Carbon Capture Project. **Scenario 4c** The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects (Scenario 4b). • Cables/pipelines: – Mooir Vannin - UK Transmission Assets operation and maintenance phase.	
Long term habitat loss	✓	✓	✗	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets. **Scenario 3** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project:	These projects will all result in the installation of hard structures on the seabed which will lead to long term habitat loss within the CEA benthic subtidal and intertidal ecology study area meaning they may also affect habitats that the Transmission Assets will also affect.

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans. Tier 1 • Offshore wind farm projects: – Awel y Môr Offshore Wind Farm; and – Mona Offshore Wind Project. • Oil and gas projects: – Isle of Man Crogga Licence. • Remedial works: – Isle of Man to UK Interconnector Cable maintenance licences (MLA/2016/00211 and MLA/2014/00201). **Scenario 4b** The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • Offshore wind farm projects: – Mooir Vannin Offshore Wind Farm. • CCS projects: – Eni Hynet CCS.	

Cumulative effect	Phase[a] C	O	D	Project(s) considered	Justification
				Scenario 4c The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects (Scenario 4b). • Cables and pipelines: – MaresConnect; – Isle of Man – UK Interconnector 2; and – Mooir Vannin - UK Transmission Assets.	
	×	×	✓	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets. **Scenario 3** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans.	These projects will all result in the installation of hard structures on the seabed which will lead to long term habitat loss within the CEA benthic subtidal and intertidal ecology study area meaning they may also affect habitats that the Transmission Assets will also affect.

Cumulative effect	Phase[a] C	O	D	Project(s) considered	Justification
				Tier 1 • Offshore wind farm projects: – Mona Offshore Wind Project. **Scenario 4b** The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • Offshore wind farm projects: – Mooir Vannin Offshore Wind Farm. **Scenario 4c** The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects (Scenario 4b). • Cables/pipelines: – Mooir Vannin - UK Transmission Assets.	
Introduction of artificial structures	✗	✓	✗	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets.	These projects will all result in the installation of hard structures on the seabed which could be colonised by new communities within the CEA benthic subtidal and intertidal ecology study area meaning they may also affect habitats that the Transmission Assets will also affect.

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				Scenario 3 MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans. Tier 1 • Offshore wind farm projects: – Awel y Môr Offshore Wind Farm operations and maintenance phase; and – Mona Offshore Wind Project construction and operations and maintenance phase. • Oil and gas projects: – Isle of Man Crogga Licence. **Scenario 4b** The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • Offshore wind farm projects: – Mooir Vannin Offshore Wind Farm operations and maintenance phase. • CCS projects: – ENI Hynet CCS.	

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				Scenario 4c The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects (Scenario 4b). • Cables/pipelines: – MaresConnect construction and operations and maintenance phase; – Isle of Man – UK Interconnector 2 construction phase; and – Mooir Vannin - UK Transmission Assets construction and operation and maintenance phase.	
	✗	✗	✓	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets. **Scenario 3** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans.	

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				Tier 1 • Offshore wind farm projects: – Mona Offshore Wind Project decommissioning phase. **Scenario 4b** The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • Offshore wind farm projects: – Mooir Vannin Offshore Wind Farm operations and maintenance phase. **Scenario 4c** The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects (Scenario 4b). • Cables/pipelines: • Mooir Vannin - UK Transmission Assets operation and maintenance phase.	
Increased risk of introduction and spread of INNS	✓	×	×	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets.	These projects will all result in the installation of hard structures on the seabed which could be colonised by new communities composed of INNS within the CEA benthic subtidal and intertidal ecology study area meaning they may also affect

Cumulative effect	Phase[a] C	O	D	Project(s) considered	Justification
				Scenario 2 MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets. **Scenario 3** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans. Tier 1 • Offshore wind farm projects: – Awel y Môr Offshore Wind Farm construction phase; and – Mona Offshore Wind Project construction phase. • Oil and gas projects: – Isle of Man Crogga Licence. **Scenario 4b** The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • CCS projects: – ENI Hynet CCS.	habitats that the Transmission Assets will also affect.

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				Scenario 4c The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects (Scenario 4b). • Cables and pipelines: – MaresConnect construction and operations and maintenance phases; and – Isle of Man – UK Interconnector 2 construction phase.	
	×	✓	×	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets. **Scenario 3** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans. Tier 1	

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				Offshore wind farm projects: – Awel y Môr Offshore Wind Farm operations and maintenance and decommissioning phases; and – Mona Offshore Wind Project operations and maintenance phase. • Oil and gas projects: – Isle of Man Crogga Licence. **Scenario 4b** The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • Offshore wind farm projects: – Mooir Vannin Offshore Wind Farm construction and operations and maintenance phases. • CCS projects: – ENI Hynet CCS. **Scenario 4c** The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects (Scenario 4b). • Cables and pipelines: – MaresConnect; – Isle of Man – UK Interconnector 2; and	

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				– Mooir Vannin - UK Transmission Assets construction and operations and maintenance phases.	
	✗	✗	✓	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets. **Scenario 3** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans. Tier 1 • Offshore wind farm projects: – Mona Offshore Wind Project decommissioning phase. **Scenario 4b** The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a).	

Cumulative effect	Phase[a] C	O	D	Project(s) considered	Justification
				• Offshore wind farm projects: – Mooir Vannin Offshore Wind Farm operations and maintenance phase. **Scenario 4c** The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects (Scenario 4b). • Cables/pipelines: – Mooir Vannin - UK Transmission Assets operation and maintenance phase.	
Removal of hard substrates	✗	✗	✓	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets. **Scenario 3** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans:	These projects will also undergo the removal of hard substrate within the period of decommissioning for the Transmission Assets.

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				Tier 1 • Offshore wind farm projects: – Mona Offshore Wind Project. **Scenario 4b** The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • Offshore wind farm projects: – Mooir Vannin Offshore Wind Farm – decommissioning phase. **Scenario 4c** The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • No overlapping projects during decommissioning phase.	
Changes in physical processes	×	✓	×	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets.	Outcome of the CEA will be greatest when the greatest number of other schemes are considered in combination. Including schemes and developments within the CEA study area to capture the potential overlap of impacts during the operation and maintenance and decommissioning phases of the Transmission Assets.

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				Scenario 3 MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans. Tier 1 • Offshore wind farm projects: – Maintenance of Walney Extension 4 Offshore Wind Farm; – Maintenance of Walney Extension 3 Offshore Wind Farm; – Maintenance of Walney 2 Offshore Wind Farm; – Maintenance of Walney 1 Offshore Wind Farm; – Maintenance of Walney export and inter array cables; and – Construction of the Mona Offshore Wind Project. • Dredging projects: – RNLI maintenance activities including beach reprofiling at Lytham St. Annes. • Remedial works: – Maintenance/repair of Isle of Man to UK interconnector and replacement of concrete mattresses used for cable protection with rock filled filter units. • Oil and gas projects: – Millom West Platform decommissioning phase. **Scenario 4b**	

Cumulative effect	Phase[a] C	O	D	Project(s) considered	Justification
				The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • Offshore wind farm projects: – Mooir Vannin Offshore Wind Farm. • CCS projects: – Proposed development of the Eni Hynet – Carbon Capture Project **Scenario 4c** The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects (Scenario 4b). • Cables/pipelines: – Mooir Vannin - UK Transmission Assets construction and operation and maintenance phases.	
	×	×	✓	**Scenario 1** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morecambe Offshore Windfarm: Generation Assets. **Scenario 2** MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with the Morgan Offshore Wind Project: Generation Assets.	

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				Scenario 3 MDS as described for the Transmission assets (**Table 2.12**) assessed cumulatively with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets. **Scenario 4a** The MDS as described for Scenario 3 assessed cumulatively with the following other projects/plans. Tier 1 • Offshore wind farm projects: – Mona Offshore Wind Project residual structures from decommissioning. • Remedial works: – Maintenance/repair of Isle of Man to UK interconnector and replacement of concrete mattresses used for cable protection with rock filled filter units. **Scenario 4b** The MDS as described for Scenario 4a assessed cumulatively with the following other projects/plans. Tier 2 • Tier 1 projects (Scenario 4a). • Offshore wind farm projects: – Mooir Vannin Offshore Wind Farm. • CCS projects: – Proposed development of the Eni Hynet – Carbon Capture Project.	

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
				Scenario 4c The MDS as described for Scenario 4b assessed cumulatively with the following other projects/plans. Tier 3 • Tier 1 and 2 projects (Scenario 4b). • Cables/pipelines: – Mooir Vannin - UK Transmission Assets operation and maintenance phase.	

[a] C=construction, O=operation and maintenance, D=decommissioning

2.13 Cumulative effects assessment

2.13.1 Introduction

2.13.1.1 A description of the significance of cumulative effects upon benthic subtidal and intertidal ecology receptors arising from each identified impact is given below.

2.13.1.2 The CEA is presented in a series of tables (one for each potential cumulative impact) and considers the following.

- Scenario 1: Transmission Assets together with Morecambe Offshore Windfarm: Generation Assets.
- Scenario 2: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets.
- Scenario 3: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets.
- Scenario 4a to 4c: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets (Scenario 3) and other relevant projects and plans.

2.13.2 Temporary subtidal habitat loss/disturbance

2.13.2.1 There is the potential for cumulative temporary habitat loss as a result of construction activities associated with the Transmission Assets and other offshore wind farms (i.e. from cable burial, jack-up activities, anchor placements and seabed preparation), dredging activities, aggregate extraction activities, cables and pipelines and remedial work. For the purposes of this ES, this additive impact has been assessed within the CEA benthic subtidal and intertidal ecology study area, defined as the area within a 50 km buffer of the Transmission Assets, using the scenario and tiered approach outlined in **section 2.12**. The 50 km buffer area captures a fair representation of benthic habitats within the study area in proximity to the Transmission Assets.

2.13.2.2 All plans/projects/activities screened into the assessment for cumulative effects from temporary habitat loss/disturbance are either on-going activities (i.e. licensed and application aggregate extraction areas) or other offshore wind farms which are consented, submitted or under construction (i.e. Tier 1). Two Tier 2 projects (Mooir Vannin Offshore Wind Project, and the ENI Hynet CCS project) and three Tier 3 projects (MaresConnect, the Isle of Man Interconnector Cable 2 and the Mooir Vannin - UK Transmission Assets) have been identified within the CEA benthic subtidal and intertidal ecology study area.

2.13.2.3 A summary of the cumulative impact for scenarios 1-3 are presented in **Table 2.27** and for scenarios 4a-4c are presented in **Table 2.28.**

2.13.2.4 A cumulative effects assessment for temporary habitat disturbance/loss including details regarding the temporary disturbance/loss associated with each project in each tier where available is presented in **A.1.2**.

Table 2.27: Cumulative temporary habitat disturbance/loss (Scenarios 1-3)

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
Construction Phase			
Sensitivity of receptor	The sensitivity of the subtidal habitat IEFs to temporary habitat loss/disturbance is as described previously for the construction phase assessment for the Transmission Assets alone in **paragraphs 2.11.2.4** to **2.11.2.29** and **Table 2.18**. **Subtidal habitat IEFs** The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high to low vulnerability and high to medium recoverability and of national value. The sensitivity of the receptor is considered to be **medium**. The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high to low vulnerability and high to medium recoverability and of national value. The sensitivity of the receptor is considered to be **medium**. The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of medium to very high vulnerability and high to medium recoverability and of national value. The sensitivity of the receptor is considered to be **medium**. The seapens and burrowing megafauna communities IEF is deemed to be of low to high vulnerability and low to high recoverability and of national value. The sensitivity of the receptor is considered to be **high** (and reduced to **medium** in the absence of seapens). The brittlestar beds IEF is deemed to be of high vulnerability and medium recoverability and of national value. The sensitivity of the receptor is considered to be **medium**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Transmission Assets; and • The Morecambe Offshore Windfarm: Generation Assets. These two projects may result in up to 17.15 km² of temporary habitat disturbance/loss.	The cumulative effects assessment for Scenario 2 considers the following: • The Transmission Assets; and • The Morgan Offshore Wind Project: Generation Assets. These two projects may result in up to 76.23 km² of temporary habitat disturbance/loss.	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets; • The Morecambe Offshore Windfarm: Generation Assets; and • The Morgan Offshore Wind Project: Generation Assets. These three projects may result in up to 78.58 km² of temporary habitat

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	This includes all of the subtidal temporary habitat loss/disturbance associated with the construction of the Transmission Assets (14.81 km^{2}) together with up to 2.34 km^{2} of temporary habitat disturbance/loss associated with the construction of the Morecambe Offshore Windfarm: Generation Assets (i.e. installation of wind turbines, OSPs and inter-array and interconnector cables; Morecambe Offshore Windfarm Ltd, 2024a). **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	This includes all of the activities associated with the construction of the Transmission Assets (14.81 km^{2}) together with up to 61.42 km^{2} of temporary habitat disturbance/loss associated with the construction of the Morgan Offshore Wind Project: Generation Assets (i.e. installation of wind turbines, OSPs and inter-array and interconnector cables for the Morgan Offshore Wind Project: Generation Assets as well as jack-up events and anchoring; Morgan Offshore Wind Ltd, 2023). **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, medium term duration, continuous and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **medium**.	disturbance/loss. This does not represent a significant increase in the area of temporary habitat disturbance/loss compared to each scenario separately. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **medium**.
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the subtidal habitat IEF receptors is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.	**Subtidal habitat IEFs** Overall, for the subtidal IEFs the magnitude of the cumulative impact is deemed to be medium and the sensitivity is considered to be medium. In accordance with the methodology for determining the significance of effects outlined in **section 2.10.4** and the matrix in **Table 2.16**, this correlates with a	**Subtidal habitat IEFs** Overall, for the subtidal IEFs the magnitude of the cumulative impact is deemed to be medium and the sensitivity of the receptor is considered to be medium. In accordance with the methodology for determining the significance of effects outlined in **section 2.10.4** and the matrix in **Table 2.16**, this

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
		moderate adverse effect, however, this would only be applicable in the short term and will not extend beyond the construction phase. As outlined in **paragraphs 2.11.2.33** to **2.11.2.34**, the sediments and associated benthic communities are predicted to recover over time, and therefore no further mitigation is required for the Transmission Assets beyond those committed to within the embedded measures (**Table 2.11**) is required to reduce the significance of the effects. The overall significance of the effects in the medium to long term is **minor adverse** significance, which is not significant in EIA terms.	correlates with a moderate adverse effect, however, this would only be applicable in the short term and will not extend beyond the construction phase. As outlined in **paragraphs 2.11.2.33** to **2.11.2.34**, the sediments and associated benthic communities are predicted to recover over time, and therefore further mitigation is required for the Transmission Assets beyond than those committed to within the embedded measures (**Table 2.11**) is required to reduce the significance of the effects. The overall significance of the effects in the medium to long term is **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures are proposed.		
Operation and Maintenance Phase			
Sensitivity of receptor	The sensitivity of the receptors remains the same as the construction phase, and as listed in **section 2.11.2**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Transmission Assets; and • The Morecambe Offshore Windfarm: Generation Assets.	The cumulative effects assessment for Scenario 2 considers the following: • The Transmission Assets; and • The Morgan Offshore Wind Project: Generation Assets.	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets; • The Morecambe Offshore Windfarm: Generation Assets; and

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	These two projects may result in up to 4.55 km^2 of temporary habitat disturbance/loss. This includes all of the subtidal temporary habitat loss/disturbance associated with the operations and maintenance of the Transmission Assets (4.40 km^2) together with up to 0.16 km^2 temporary habitat disturbance/loss associated with the operations and maintenance of the Morecambe Offshore Windfarm: Generation Assets (i.e. jack up events and cable repair and replacement; Morecambe Offshore Windfarm Ltd, 2024a). This cumulative impact from the two projects will occur intermittently across the 35 year life span of the Transmission Assets. **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	These two projects may result in up to 15.76 km^2 of temporary habitat disturbance/loss. This includes all of the subtidal temporary habitat loss/disturbance associated with the operations and maintenance of the Transmission Assets (4.40 km^2) together with up to 11.36 km^2 of temporary habitat disturbance/loss associated with the operations and maintenance of the Morgan Offshore Wind Project: Generation Assets (i.e. jack up events and repair and replacement for the inter-array and interconnector cables; Morgan Offshore Wind Ltd, 2023). This cumulative impact from the two projects will occur intermittently across the 35 year life span of the Transmission Assets. **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	• The Morgan Offshore Wind Project: Generation Assets. These three projects may result in up to 15.92 km^2 of temporary habitat disturbance/loss. This does not represent a significant increase in the area of temporary habitat disturbance/loss compared to each scenario separately. **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.
Significance of effect	**Subtidal habitat IEFs** Overall, for the subtidal habitat IEFs the magnitude of the cumulative impact is deemed to be low and the sensitivity is considered to be medium. The cumulative	**Subtidal habitat IEFs** Overall, for the subtidal habitat IEFs the magnitude of the cumulative impact is deemed to be low and the sensitivity is considered to be medium. The cumulative	**Subtidal habitat IEFs** Overall, for the subtidal habitat IEFs the magnitude of the cumulative impact is deemed to be low and the sensitivity is considered to be medium. The cumulative

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.	effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.	effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		
Decommissioning Phase			
Sensitivity of receptor	The sensitivity of the receptors remains the same as the construction phase, and as listed in **section 2.11.2**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Transmission Assets; and • The Morecambe Offshore Windfarm: Generation Assets. These two projects may result in a similar level of temporary habitat disturbance/loss as in the construction phase which had the potential to result in up to 17.15 km^2 of temporary habitat disturbance/loss. This assumes that the extent of temporary habitat disturbance during the decommissioning phase could be the same as in the construction phase. This is, however, highly precautionary with the actual value is likely to be much lower as activities such as sandwave clearance may not be required during decommissioning. The MDS for the decommissioning phase assumes the	The cumulative effects assessment for Scenario 2 considers the following: • The Transmission Assets; and • The Morgan Offshore Wind Project: Generation Assets. These two projects may result in a similar level of temporary habitat disturbance/loss as in the construction phase which had the potential to result in up to 76.23 km^2 of temporary habitat disturbance/loss. This assumes that the extent of temporary habitat disturbance during the decommissioning phase could be the same as it is in the construction phase. This is, however, highly precautionary as the actual value is likely to be much lower as activities such as sandwave clearance may not be required during decommissioning. The MDS for the decommissioning phase assumes the	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets; • The Morecambe Offshore Windfarm: Generation Assets; and • The Morgan Offshore Wind Project: Generation Assets. These three projects may result in a similar level of temporary habitat disturbance/loss as in the construction phase which had the potential to result in up to 78.58 km^2 of temporary habitat disturbance/loss. This does not represent a significant increase in the area of temporary habitat disturbance/loss compared to each scenario separately. **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, medium term duration,

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	removal of cables for both projects and the removal of wind turbines, OSPs and cable protection for the Morecambe Offshore Windfarm: Generation Assets (Morecambe Offshore Windfarm Ltd, 2024a). **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	removal of cables for both projects and the removal of wind turbines and OSPs for the Morgan Offshore Wind Project: Generation Assets (Morgan Offshore Wind Ltd, 2023). **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, medium term duration, continuous and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.
Significance of effect	**Subtidal habitat IEFs** Overall, for the subtidal habitat IEFs the magnitude of the cumulative impact is deemed to be low and the sensitivity of the subtidal habitat IEF receptors is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.	**Subtidal habitat IEFs** Overall, for the subtidal habitat IEFs the magnitude of the cumulative impact is deemed to be low and the sensitivity of the subtidal habitat IEF receptors is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.	**Subtidal habitat IEFs** Overall, for the subtidal habitat IEFs the magnitude of the cumulative impact is deemed to be low and the sensitivity of the subtidal habitat IEF receptors is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

Table 2.28: Cumulative temporary habitat disturbance/loss (Scenarios 4a-4c)

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) and Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
Construction Phase			
Sensitivity of receptor	The sensitivity of the subtidal habitat IEFs to temporary habitat loss/disturbance is as described previously for the construction phase assessment for the Transmission Assets alone in **paragraphs 2.11.2.4** to **2.11.2.29** and **Table 2.18**. **Subtidal habitat IEFs** The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high to low vulnerability and high to medium recoverability and of national value. The sensitivity of the receptor is considered to be **medium**. The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high to low vulnerability and high to medium recoverability and of national value. The sensitivity of the receptor is considered to be **medium**. The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of medium to very high vulnerability and high to medium recoverability and of national value. The sensitivity of the receptor is considered to be **medium**. The seapens and burrowing megafauna communities IEF is deemed to be of low to high vulnerability and low to high recoverability and of national value. The sensitivity of the receptor is considered to be **high** (and reduced to **medium** in the absence of seapens). The brittlestar beds IEF is deemed to be of high vulnerability and medium recoverability and of national value. The sensitivity of the receptor is considered to be **medium**. **Fylde MCZ IEFs** The subtidal sand IEF of the Fylde MCZ is deemed to be of medium vulnerability, high recoverability, and national value. The sensitivity of the receptor is therefore considered to be **medium**. The subtidal mud IEF of the Fylde MCZ is deemed to be of very high vulnerability and high to medium recoverability, and of national importance. The sensitivity of the receptor is therefore considered to be **medium**.		
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 together with the following Tier 1 projects: • Mona Offshore Wind Project; • Walney Offshore Windfarm Extension;	The cumulative effects assessment for Scenario 4b considers Scenario 4a with the following Tier 2 projects: • ENI Hynet CCS; and • Liverpool Bay Area 457.	The cumulative effects assessment for Scenario 4c considers Scenario 4b with the following Tier 3 projects: • MaresConnect; and • Isle of Man Interconnector Cable 2.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) and Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	• West of Duddon Sand Offshore Windfarms; • Walney 1 Offshore Windfarm; • Walney 2 Offshore Windfarm; • Barrow Offshore Windfarm; • Ormonde Offshore Windfarm; • Burbo Bank Offshore Windfarm; • Burbo Bank Extension Offshore Windfarm; • Gwynt Y Môr Offshore Windfarm; • Awel Y Môr Offshore Windfarm; • North Hoyle Offshore Windfarm; and • Rhyl Flats Offshore Windfarm. Tier 1 projects also include various dredging sites, the ongoing decommissioning of an oil and gas platform and interconnector cable remedial work (**Table 2.26**). The Transmission Assets, Generation Assets, and Tier 1 projects may result in up to 156.23 km^2 of temporary habitat disturbance/loss. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The	The Transmission Assets, Generation Assets, Tier 1 and Tier 2 projects may result in up to 159.47 km^2 of temporary habitat disturbance/loss. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **medium**. **Fylde MCZ IEFs** There are no tier 2 projects which spatially overlap with the Fylde MCZ, therefore no tier 2 assessment of the impact on the Fylde MCZ is required for any phase beyond the assessment for scenario 4a.	There is currently no information on the impact that the MaresConnect interconnector cable will have on benthic ecology receptors. Furthermore the Isle of Man to UK Interconnector 2 may be under construction during the Transmission Assets, Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets construction phases. There is currently very limited information available on this project however it is understood that the project is likely to commence construction before 2030 (Manx Utilities, 2023). The seabed disturbance associated with these projects is likely to be similar in both nature and magnitude to that arising from the installation of export cables for the Transmission Assets. As Tier 3 projects there is limited information available in this respect, however it is anticipated that this impact would be temporary in nature and of limited scale. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **medium**.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) and Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	magnitude is therefore, considered to be **medium**. **Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.		**Fylde MCZ IEFs** There are no tier 2 projects which spatially overlap with the Fylde MCZ, therefore no tier 2 assessment of the impact on the Fylde MCZ is required for any phase beyond the scenario for 4a.
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is deemed to be medium and the sensitivity of the receptor is considered to be medium. In accordance with the methodology for determining the significance of effects outlined in **section 2.10.4** and the matrix in **Table 2.16**, this correlates with a moderate adverse effect, however, this would only be applicable in the short term and will not extend beyond the construction phase. As outlined in **paragraphs 2.11.2.33** to **2.11.2.34**, the sediments and associated benthic communities are predicted to recover over time, and therefore no mitigation is required to reduce the significance of the effects. The overall significance of the effects in the medium to long term is **minor adverse** significance, which is not significant in EIA terms. **Fylde MCZ IEFs**	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is deemed to be medium and the sensitivity of the receptor is considered to be medium. In accordance with the methodology for determining the significance of effects outlined in **section 2.10.4** and the matrix in **Table 2.16**, this correlates with a moderate adverse effect, however, this would only be applicable in the short term and will not extend beyond the construction phase. As outlined in **paragraphs 2.11.2.33** to **2.11.2.34**, the sediments and associated benthic communities are predicted to recover over time, and therefore no mitigation is required to reduce the significance of the effects. The overall significance of the effects in the medium to long term is **minor adverse** significance, which is not significant in EIA terms.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is deemed to be medium and the sensitivity of the receptor is considered to be medium. In accordance with the methodology for determining the significance of effects outlined in **section 2.10.4** and the matrix in **Table 2.16**, this correlates with a moderate adverse effect, however, this would only be applicable in the short term and will not extend beyond the construction phase. As outlined in **paragraphs 2.11.2.33** to **2.11.2.34**, the sediments and associated benthic communities are predicted to recover over time, and therefore no mitigation is required to reduce the significance of the effects. The overall significance of the effects in the medium to long term is **minor adverse** significance, which is not significant in EIA terms.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) and Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.		
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		
Operation and Maintenance Phase			
Sensitivity of receptor	The sensitivity of the receptors for both the subtidal habitat IEFs and the Fylde MCZ IEFs will be the same as during the construction phase, and as listed in **section 2.11.2**.		
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 together with the following Tier 1 projects: • Mona Offshore Wind Project; • Walney Offshore Windfarm Extension; • West of Duddon Sand Offshore Windfarms; • Walney 1 Offshore Windfarm; • Walney 2 Offshore Windfarm; • Ormonde Offshore Windfarm; • Burbo Bank Offshore Windfarm; • Burbo Bank Extension Offshore Windfarm; • Gwynt Y Môr Offshore Windfarm;	The cumulative effects assessment for Scenario 4b considers Scenario 4a together with the following Tier 2 project: • Mooir Vannin Offshore Windfarm. Tier 2 also includes the CCS project ENI Hynet and the Liverpool Bay Area 457 aggregate extraction site (**Table 2.26**). The Transmission Assets, Morgan Offshore Wind Project: Generation Assets, Morecambe Offshore Windfarm: Generation Assets, Tier 1 and Tier 2 projects may result in up to 55.68 km^2 of temporary habitat disturbance/loss, excluding Mooir Vanning due to the absence of data available to quantify the impact for this project. **Subtidal habitat IEFs**	The cumulative effects assessment for Scenario 4c considers Scenario 4b together with the following Tier 3 projects: • MaresConnect construction and operation and maintenance phase; • Isle of Man – UK Interconnector 2; and • Mooir Vannin – UK Transmission Assets. There is currently no information on the impact that the MaresConnect interconnector cable will have on benthic ecology receptors. Furthermore the Isle of Man to UK Interconnector 2 will be operational during the Transmission Assets operational phase. There is currently very limited information available on this project however it is

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) and Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	• Awel Y Môr Offshore Windfarm; and • North Hoyle Offshore Windfarm. Tier 1 projects also include various dredging sites, the ongoing decommissioning of an oil and gas platform and interconnector cable remedial work (**Table 2.26**). The Transmission Assets, Morgan Offshore Wind Project: Generation Assets, Morecambe Offshore Windfarm: Generation Assets and Tier 1 projects may result in up to 53.11 km^2 of temporary habitat disturbance/loss. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	understood that the project is likely to commence construction before 2030 (Manx Utilities, 2023). Based on current information, the Mooir Vannin – UK Transmission Assets are likely to be operational by 2032. The Mooir Vannin – UK Transmission Assets is likely to comprise multiple HVAC or HVDC cables, with a point of interconnection at Penwortham, and could potentially include a booster station if HVAC cables are utilised (Mooir Vannin Offshore Wind Farm Limited, 2024). There is the potential for both the Mooir Vannin – UK Transmission Assets and the Isle of Man to UK Interconnector 2 to overlap with the Fylde MCZ and result in disturbance to the designated features during maintenance activities. The seabed disturbance associated with these three projects is likely to be similar in both nature and magnitude to that arising from the maintenance of export cables for the Transmission Assets. As Tier 3 projects there is limited information available in this respect, however it is anticipated that this impact would be temporary in nature and of limited scale. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) and Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
			will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) and Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		
Decommissioning Phase			
Sensitivity of receptor	The sensitivity of the receptors for both the subtidal habitat IEFs and the Fylde MCZ IEFs will be the same as during the construction phase, and as listed in **section 2.11.2**.		
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 together with the following Tier 1 project: • Mona Offshore Wind Project. The Transmission Assets, Morgan Offshore Wind Project: Generation Assets, the Morecambe Offshore Windfarm: Generation Assets and Tier 1 projects may result in a similar level of temporary habitat disturbance/loss as the construction phase which may result in up to 156.23 km^2 of temporary habitat disturbance/loss. This assumes that the extent of temporary habitat disturbance during the decommissioning phase could be the same as in the construction phase. This is, however, highly precautionary with the actual value is likely to be much lower as activities such as sandwave clearance may not be required during decommissioning. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and high reversibility.	The cumulative effects assessment for Scenario 4b considers Scenario 4a together with the following Tier 2 project: • Mooir Vannin – Isle of Man Windfarm lease area. The Transmission Assets, Morgan Offshore Wind Project: Generation Assets, Morecambe Offshore Windfarm: Generation Assets and Tier 1, and Tier 2 projects may result in a similar level of temporary habitat disturbance/loss as the construction phase which may result in up to 159.47 km^2 of temporary habitat disturbance/loss, excluding Mooir Vannin, due to the absence of data available to quantify this impact for this project. This assumes that the extent of temporary habitat disturbance during the decommissioning phase could be the same as in the construction phase. This is, however, highly precautionary with the actual value is likely to be much lower as activities such as sandwave clearance may not be required during decommissioning.	The cumulative effects assessment for Scenario 4c considers Scenario 4b together with the following Tier 3 project: • Mooir Vannin – UK Transmission Assets. During the decommissioning phase of the Transmission Assets the Mooir Vannin – UK Transmission Assets are likely to be in their operation and maintenance phase. The activities involved in this phase of the project are likely to involve the repair and reburial of cable as well as any structural maintenance to the booster station resulting in disturbance at a similar magnitude to the Transmission Assets. There is the potential for the Mooir Vannin – UK Transmission Assets to overlap with the Fylde MCZ and result in disturbance to the designated features during maintenance activities. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, medium term

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) and Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	**Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

2.13.3 Increase in suspended sediment concentration and associated deposition

2.13.3.1 Increases in SSC may arise due to seabed preparation involving sandwave clearance activities and the installation, repair and removal of export cables. Should the other projects cited take place concurrently with the Transmission Assets (construction, operation and maintenance, or decommissioning phase), there is potential for cumulative increased turbidity levels.

2.13.3.2 The CEA for impacts associated with increases in SSC and sediment deposition for scenarios 1 to 3 are presented in **Table 2.29** and for scenarios 4a to 4c in **Table 2.30**.

Table 2.29: Cumulative assessment of the increase in SSC and associated deposition (Scenarios 1-3)

<table>
<tr><th></th><th>Scenario 1:
Transmission Assets + Morecambe Offshore Windfarm: Generation Assets</th><th>Scenario 2:
Transmission Assets + Morgan Offshore Wind Project: Generation Assets</th><th>Scenario 3:
Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets</th></tr>
<tr><td colspan="4">Construction Phase</td></tr>
<tr><td>Sensitivity of receptor</td><td colspan="3">Subtidal habitat IEFs (as discussed in section 2.11.3)
The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of low to medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be low.
The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is negligible.
The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of medium vulnerability, high recoverability, and national value. The sensitivity of the receptor is low.
The brittlestar beds IEF is deemed of high vulnerability, medium recoverability and of national value. The sensitivity of the receptor is therefore, considered to be medium.
The low resemblance stony reef IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is negligible.
The seapens and burrowing megafauna IEF is deemed to be of low vulnerability, high recoverability and national value. This IEF is therefore deemed to not be sensitive to this impact. The sensitivity of the seapens and burrowing megafauna IEF is therefore negligible.
Shell Flat and Lune Deep SAC IEFs
The sandbanks which are slightly covered by sea water IEF is deemed to be of medium vulnerability and high recoverability and international value. The sensitivity of the receptor is therefore, considered to be low.
The reef IEF is deemed to be of medium vulnerability and high recoverability and international value. The sensitivity of the receptor is therefore, considered to be low.
Fylde MCZ IEFs
The subtidal sand IEF is deemed to be of medium vulnerability and high recoverability and national value. The sensitivity of the receptor is therefore, considered to be low.
The subtidal mud IEF is deemed to be of low vulnerability and high recoverability and national value. The sensitivity of the receptor is therefore, considered to be negligible.</td></tr>
</table>

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	West of Walney MCZ IEFs The subtidal sand IEF of the West of Walney MCZ is deemed to be of low to medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. The subtidal mud IEF of the West of Walney MCZ is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. The seapens and burrowing megafauna IEF of the West of Walney MCZ is deemed to be of low vulnerability, high recoverability and national value. This IEF is therefore deemed to not be sensitive to this impact. The sensitivity of the seapens and burrowing megafauna IEF is therefore **negligible**. **West of Copeland MCZ IEFs** The subtidal coarse sediment IEF of the West of Copeland MCZ is deemed to be of medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**. The subtidal mixed sediment IEF of the West of Copeland MCZ is deemed to be of medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**. The subtidal sand IEF of the West of Copeland MCZ is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. **Intertidal habitat IEFs** The species poor/barren sands IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**. The polychaete/bivalve-dominated muddy sand shores IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**. The *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Transmission Assets; and	The cumulative effects assessment for Scenario 2 considers the following: • The Transmission Assets; and	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets;

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	• The Morecambe Offshore Windfarm: Generation Assets. The construction phases of these projects include activities which will give rise to increased SSC, namely site preparation/sandwave clearance and cable installation. Remobilised and redistributed material may reach the south edges of the West of Copeland MCZ, West of Walney MCZ and Shell Flat feature of the Shell Flat and Lune Deep SAC in depths indistinguishable from background levels. With the cable corridor passing though Fylde MCZ, this site would be directly affected with sedimentation levels beyond the immediate vicinity of the trench circa 10 mm and reducing to <1 mm within 2 km. Noting that much of the displaced material would, in reality, be used to backfill the trench. The MDS for the Morecambe Offshore Windfarm: Generation Assets includes seabed preparation for 35 conical gravity bases, two conical gravity base OSPs, up to 8 km of sandwave clearance, foundation installation of 30 monopile wind turbine structures, two monopile OSPs and 80 km of cable trenching. In terms of sedimentation, 'light' deposition is anticipated to deposit on a small proportion of the Fylde MCZ and Shell Flat and Lune	• The Morgan Offshore Wind Project: Generation Assets. The construction phases of these projects include activities which will give rise to increased SSC, namely site preparation/sandwave clearance and cable installation. Remobilised and redistributed material may reach the south edges of the West of Copeland MCZ, West of Walney MCZ and the Shell Flat feature of the Shell Flat and Lune Deep SAC in depths indistinguishable from background levels. With the cable corridor passing though Fylde MCZ and the Ribble Estuary designations, this site would be directly affected with sedimentation levels beyond the immediate vicinity of the trench circa 10 mm and reducing to <1 mm within 2 km. Noting that much of the displaced material would, in reality, be used to backfill the trench. During the construction phase of the Transmission Assets there is the potential for cumulative impacts with the Morgan Offshore Wind Project: Generation Assets which is programmed on a similar timeframe. Construction activities for the MDS for SSC include site preparation with sandwave clearance along 286 km inter-array and interconnector cables, installation of up to 45 three-legged jacket piles, 23	• The Morecambe Offshore Windfarm: Generation Assets; and • The Morgan Offshore Wind Project: Generation Assets. The construction phases of these projects include activities which will give rise to increased SSC, namely site preparation/sandwave clearance and cable installation. These three projects do not represent a significant increase in SSC and associated deposition compared to each scenario separately. This being due to the fact the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets are separated by a distance of 16.76 km and owing to the principal orientation of the tidal currents, no increased cumulative effect between the two projects are predicted to occur, given the relationship of these projects site preparation and installation of infrastructure would be phased and SSC increases would not occur concurrently. The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	Deep SAC Annex I sandbanks. Furthermore there will be no impact upon the intertidal habitats. It is noted that given the relationship of these projects site preparation and installation of infrastructure would be phased and SSC increases would not occur concurrently. However should multiple operations be undertaken plumes would be advected on the tide and not towards one another and these activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration. In both cases the majority of sedimentation would occur within close proximity to each installation however, given the active sediment transport regime deposited material would be redistributed across the vicinity. The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	conical gravity base foundations, a six-legged OSP with three piles per leg and trenching for 450 km of inter-array and interconnector cables. Sedimentation depth is typically <50 mm beyond the immediate vicinity of the installation and less than one tenth of this value in the wider domain and is generally limited to the Morgan Offshore Wind Project: Generation Assets. The SSC plumes may extend to the West of Walney MCZ and the West of Copeland MCZ on the flood tide however sediment concentrations are dispersed to well below background levels at these locations and sedimentation levels are de minimis. Additionally there will be no impact upon intertidal habitats as they are further from the site of any installation than the MCZs. It is noted that given the relationship of these projects site preparation and installation of infrastructure would be phased and SSC increases would not occur concurrently. However should multiple operations be undertaken plumes would be advected on the tide and not towards one another and these activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration.	

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
		In both cases the majority of sedimentation would occur within close proximity to each installation however, given the active sediment transport regime deposited material would be redistributed across the vicinity. The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **low**.	
Significance of effect	**Subtidal habitat IEFs** Overall, for the subtidal muddy sands with relatively species poor benthic communities IEF, the low resemblance stony reef IEF, and the seapens and burrowing megafauna IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. Overall, for the subtidal sandy sediments characterised by relatively diverse infaunal	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. Overall, for the subtidal muddy sands with relatively species poor benthic communities IEF, the low resemblance stony reef IEF,	In terms of impacts due to overlapping SSC and deposition the magnitude of impact will be no greater than that presented for scenario 1 or 2. This being due to the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets being separated by a distance of 16.76 km and owing to the principal orientation of the tidal currents, therefore no increased cumulative effect between the two projects are predicted to occur. As this scenario does not represent a large increase in the significance of the impact, the significances for the receptors from Scenario 2 will apply equally to this scenario.

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	and epifaunal benthic communities IEF the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be low. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. Overall, for the brittlestar beds IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptors is considered to be low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF of the Fylde MCZ is low. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.	and the seapens and burrowing megafauna IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. Overall, for the brittlestar beds IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments, with the slightly higher sensitivity of this IEF. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is	

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant. **West of Walney MCZ IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptors is considered to be negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **West of Copeland MCZ IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptors is considered to be low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptors is considered to be negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	not significant in EIA terms. This has been concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF of the Fylde MCZ is low. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing background sediments after a short period of time. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **West of Walney MCZ IEFs**	

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
		Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **West of Copeland MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse sediment IEF and the subtidal mixed sediment IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptors is considered to be negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA	

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
		terms. This has been concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.	
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		
Operation and Maintenance Phase			
Sensitivity of receptor	The sensitivity of the receptors will be the same as described for the construction phase, and as listed in **section 2.11.3**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following. • The Transmission Assets. • The Morecambe Offshore Windfarm: Generation Assets. The operations and maintenance phases of these projects include activities which may result in increased SSC, including cable reburial and repair. If cables repairs are undertaken within a distance of 5 km of the Fylde MCZ, then the magnitude of impact would be as described for the construction phase in the previous section for each event but the length of burial would be significantly less and therefore more localised impacts.	The cumulative effects assessment for Scenario 2 considers the following. • The Transmission Assets. • The Morgan Offshore Wind Project: Generation Assets. The operations and maintenance phases of these projects include activities which may result in increased SSC, including cable reburial and repair. If cables repairs are undertaken within a distance 5 km of the Fylde MCZ, then the magnitude of impact would be as described for the construction phase in the previous section for each event but the length of burial would be significantly less and therefore more localised impacts.	The cumulative effects assessment for Scenario 3 considers the following. • The Transmission Assets. • The Morecambe Offshore Windfarm: Generation Assets. • The Morgan Offshore Wind Project: Generation Assets. The operations and maintenance phases of these projects include activities which may result in increased SSC, including cable reburial and repair. The magnitude of the cumulative effect to suspended sediments and subsequent deposition from the Transmission Assets, Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	**Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets**	**Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets**
	The Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets are on the same projected timeline and will therefore both be in the operation and maintenance phase. Potential cumulative impacts may relate to the reburial of up to 100 m of inter-array cables per year and the repair of 200 m of inter-array cable per year at Morecambe Offshore Windfarm: Generation Assets per year. However, maintenance activities are both intermittent and a smaller scale than that of the construction phase and therefore any potential cumulative impacts are less likely to occur and be on a smaller scale. If maintenance works to the Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets occur simultaneously, it is likely that suspended sediment plumes from export cable and inter array cable repair or reburial could interact. However, these activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration. The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.	The Transmission Assets and the Morgan Offshore Wind Project: Generation Assets are on the same projected timeline and will therefore both be in the operation and maintenance phase concurrently. Potential cumulative impacts may relate to cable repair and reburial activities for inter-array and interconnector cables. The MDS for repair and reburial of inter-array cables is for up to 8 km in one event every five years and 20 km in one event every five years. Similarly, for the interconnector the MDS states three repair events of 19.63 km in 10 years and one reburial event of up to 3 km every five years. However, maintenance activities are both intermittent and a smaller scale than that of the construction phase and therefore any potential cumulative impacts are less likely to occur and be on a smaller scale. If maintenance works to Transmission Assets and the Morgan Offshore Wind Project: Generation Assets occur simultaneously, it is likely that suspended sediment plumes from cable repair or reburial could interact. However, these activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration. The cumulative effect is predicted to be of local spatial extent, short term duration,	Windfarm: Generation Assets will be a combination of scenario 1 and 2 in a spatial sense. However, in terms of impacts due to overlapping SSC and deposition the magnitude of impact will be no greater than the scenario 1 or 2. This being due to the fact the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets are separated by a distance of 16.76 km and owing to the principal orientation of the tidal currents, no increased cumulative effect between the two projects are predicted to occur. The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
		intermittent and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.	
Significance of effect	**Subtidal habitats IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF, the low resemblance stony reef IEF and the seapens and burrowing megafauna communities IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the brittlestar beds IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of	**Subtidal habitats IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant. Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF, the low resemblance stony reef IEF and the seapens and burrowing megafauna communities IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the brittlestar beds IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of	In terms of impacts due to overlapping SSC and deposition the magnitude of impact will be no greater than that presented for scenario 1 or 2. This being due to the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets being separated by a distance of 16.76 km and owing to the principal orientation of the tidal currents, therefore no increased cumulative effect between the two projects are predicted to occur. As this scenario does not represent a large increase in the significance of the impact, the significances for the receptors from Scenario 2 will apply equally to this scenario.

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	minor adverse significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF of the Shell Flat and Lune Deep SAC is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ is low and negligible respectively. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **West of Walney MCZ IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. **West of Copeland MCZ IEFs**	**minor** adverse significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ is low and negligible respectively. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ is low and negligible respectively. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **West of Walney MCZ IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. **West of Copeland MCZ IEFs**	

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal coarse sediment IEF and the subtidal mixed sediment IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is no change and the sensitivity of the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal coarse sediment IEF and the subtidal mixed sediment IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is no change and the sensitivity of the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
Decommissioning Phase			
Sensitivity of receptor	The sensitivity of the receptors will be the same as described for the construction phase, and as listed in **section 2.11.3**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Transmission Assets; and • The Morecambe Offshore Windfarm: Generation Assets. Decommissioning of these projects will include activities which could result in increased SSC. The magnitude of the increase in SSCs arising from decommissioning activities has been described in **section 2.11.2** as having an MDS, at worst, equal to the construction phase. The primary source of SSC increase would be through the removal of cabling through similar trenching techniques as implemented during installation. Decommissioning of the Morecambe Offshore Windfarm: Generation Assets will most likely occur on the same projected timeline as the Transmission Assets, with cumulative impacts of the same magnitude described for the construction phase to be expected. The cumulative effect is predicted to be of local spatial extent, short term duration,	The cumulative effects assessment for Scenario 2 considers the following: • The Transmission Assets; and • The Morgan Offshore Wind Project: Generation Assets. Decommissioning of these projects will include activities which could result in increased SSC. The magnitude of the increase in SSCs arising from decommissioning activities for the Transmission Assets has been described in **section 2.11.2** as having at a worst, an impact equal to the construction phase. The primary source of SSC increase would be through the removal of cabling through similar trenching techniques as implemented during installation. Decommissioning of the Morgan Offshore Wind Project: Generation Assets will most likely occur on the same projected timeline as the Transmission Assets with cumulative impacts of the same magnitude described for the construction phase to be expected. The cumulative effect is predicted to be of local spatial extent, short term duration,	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets; • The Morecambe Offshore Windfarm: Generation Assets; and • The Morgan Offshore Wind Project: Generation Assets. Decommissioning of these projects will include activities which could result in increased SSC. The magnitude of the cumulative effect to suspended sediments and subsequent deposition from the Transmission Assets Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets will be a combination of scenario 1 and 2 in a spatial sense. However, in terms of impacts due to overlapping SSC and deposition the magnitude of impact will be no greater than the scenario 1 or 2. This being due to the fact the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets are separated by a 16.76 km distance and owing to the principal orientation of the tidal

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	intermittent and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **low**.	currents, no increased cumulative effect between the two projects are predicted to occur. The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF, the low resemblance stony reef IEF and the seapens and burrowing megafauna communities IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF, the low resemblance stony reef IEF and the seapens and burrowing megafauna communities IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	In terms of impacts due to overlapping SSC and deposition the magnitude of impact will be no greater than that presented for scenario 1 or 2. This being due to the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets being separated by a distance of 16.76 km and owing to the principal orientation of the tidal currents, therefore no increased cumulative effect between the two projects are predicted to occur. As this scenario does not represent a large increase in the significance of the impact, the significances for the receptors from Scenario 2 will apply equally to this scenario.

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	Overall, the magnitude of the cumulative impact is low and the sensitivity of the brittlestar beds IEF is medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF of the Fylde MCZ is low. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	Overall, the magnitude of the cumulative impact is low and the sensitivity of the brittlestar beds IEF is medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF of the Fylde MCZ is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	West of Walney MCZ Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. **West of Copeland MCZ** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse sediment IEF and the subtidal mixed sediment IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine	**West of Walney MCZ** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **West of Copeland MCZ** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse sediment IEF and the subtidal mixed sediment IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore	

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

Table 2.30: Cumulative assessment of the increase in SSC and associated deposition (Scenarios 4a-4c)

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
Construction Phase			
Sensitivity of receptor	The sensitivity of all receptors are the same as in Scenario 3, based on the alone assessment, and as listed in **section 2.11.3**.		
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 together with the following Tier 1 projects: • Maintenance of Walney Extension 4 Offshore Wind Farm; • Maintenance of Walney Extension 3 Offshore Wind Farm; • Maintenance of Walney 2 Offshore Wind Farm; • Maintenance of Walney 1 Offshore Wind Farm; • Maintenance of Walney export and inter array cables; • Maintenance of West of Duddon Sands Offshore Wind Farm; • Maintenance of Barrow Offshore Wind Farm; • Construction of the Mona Offshore Wind Project; • RNLI maintenance activities including beach reprofiling at Lytham St. Annes; • Ribble Estuary dredging and dump at sea;	The cumulative effects assessment for Scenario 4b considers Scenario 4a, together with the following Tier 2 projects: • Proposed development of Mooir Vannin Offshore Wind Farm; • Proposed development of Eni Hynet – Carbon Capture Project; and • Operation of the Westminster Gravels Aggregate Extraction site – Liverpool Bay Area 457. The magnitude of the increase in suspended sediment concentrations arising from seabed preparation involving sandwave clearance and the installation of the Transmission Assets has been assessed as low. Remobilised and redistributed material may reach the south edges of West of Copeland MCZ, West of Walney MCZ and Shell Flat feature of the Shell Flat and Lune Deep SAC in depths indistinguishable from background levels. With the cable corridor passing though Fylde MCZ, this area would be directly affected with sedimentation levels beyond the immediate vicinity of the trench circa 10 mm and reducing to < 1 mm within 2 km. Noting that much of the displaced material	The cumulative effects assessment for Scenario 4b considers Scenario 4a together with the following Tier 3 projects: • Construction of the Isle of Man to UK Interconnector Cable 2. The construction of a second interconnector cable between the Isle of Man and the UK may occur during the construction phase of the Transmission Assets as it is due to be operational in 2030. Interconnector cable installation activities would likely be of similar magnitude and extent as those associated with the Transmission Assets cable installation operations. Dependent on the detailed design and cable routing associated with the interconnector cable a cumulative impact may arise with the Transmission Assets with respect to the West of Copeland MCZ and the West of Walney MCZ designated receptors. As a Tier 3 project there is limited information available in this respect, however it is anticipated that this impact would be temporary in nature and of limited scale. Dependent on the detailed design and cable routing associated with the interconnector cable a cumulative impact

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	• Disposal of Douglas Harbour Dredging material at Douglas Head Disposal Site; and • Maintenance/repair of Isle of Man to UK interconnector and replacement of concrete mattresses used for cable protection with rock filled filter units. Remobilised and redistributed material may reach the south edges of the West of Copeland MCZ, West of Walney MCZ and the Shell Flat feature of the Shell Flat and Lune Deep SAC in depths indistinguishable from background levels. With the cable corridor passing though the Fylde MCZ and the Ribble Estuary designations, these sites would be directly affected with sedimentation levels beyond the immediate vicinity of the trench circa 10 mm and reducing to <1 mm within 2 km. Noting that much of the displaced material would, in reality, be used to backfill the trench. The construction phase of the Transmission Assets, the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets coincides with the maintenance phases of the Barrow Offshore Wind Farm, Walney 1, Walney 2, Walney Extension 3 and Walney Extension 4 Offshore Wind Farm and associated export and inter array cables, and West of Duddon Sands Offshore Wind Farm. In each case for the maintenance of offshore wind projects, activities are associated with repair and reburial of	would, in reality, naturally backfill the trench. There is also potential for cumulative impacts with the proposed development of the Mooir Vannin Offshore Wind Farm installation although as a Tier 2 project there is limited data available. Typical construction activities such as site preparation and cable trenching may result in increased suspended sediment concentration. However, given the alignment of the site and the north east to south west orientation of the tidal flow at this location, sediment plumes and subsequent sedimentation would have limited overlap. There is potential for overlap with the proposed development of the Eni Hynet – Carbon Capture Project during the construction phase, although also as a Tier 2 project there is limited data available. Various activities may be undertaken and suspended sediments may arise from Eni Hynet – Carbon Capture Project during both cable installation, platform installation and wellhead drilling. However, given the distance between the development and the Transmission Assets/Generation Assets, and the fact it is located directly to the south, it is not expected that a cumulative increase in SSC or deposition will occur. With suspended sediments instead moving east – west in parallel with those of the Transmission Assets/ Morgan Offshore Wind Project: Generation	may arise with the Transmission Assets with respect to the West of Copeland MCZ and the West of Walney MCZ designated receptors. As a Tier 3 project there is limited information available in this respect, however it is anticipated that this impact would be temporary in nature and of limited scale. **Subtidal habitat IEFs, Fylde MCZ IEFs, West of Walney MCZ IEFs, Intertidal habitat IEFs and Shell Flat and Lune Deep SAC IEFs** The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **low**. **West of Copeland MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **low**.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	cables and would be characterised by short term intermittent mobilisation of sediment along relatively short sections of cables. The Walney sites and West of Duddon Sands are located within the West of Walney MCZ and would therefore directly affect this MCZ. Similarly, with prevalent tidal currents in an east – west orientation elevated SSC arising from reburial operations at Barrow may reach the West of Walney MCZ on ebb tides. However, with the orientation the maintenance operations are unlikely to affect the Shell Flat and Lune Deep SAC and the Fylde MCZ. Should cable trenching operations, particularly on the northside of the Transmission Assets, the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets, coincide with these maintenance activities there is the potential for cumulative impacts. It is noted that sediment plumes would be carried in concert with the tide, and not towards one another, therefore the cumulative impacts would relate to potential sedimentation. It has been shown that sedimentation principally occurs at the site of operations, therefore given the limited nature of the maintenance activities and the distance between the sites this would be constrained. In terms of the West of Walney MCZ, the contribution of sedimentation from the Transmission Assets is at depths	Assets/Morecambe Offshore Windfarm: Generation Assets. There also remains the potential for the construction phase of the proposed development to overlap with the operation of the Westminster Gravels Aggregate Extraction Area 457. Both the installation of cables associated with the Transmission Assets and the processes of aggregate extraction will increase suspended sediment concentrations and thus if carried out simultaneously have the ability to create a cumulative impact; although the contribution from extraction activities will depend largely on the volume and method used to remove material. Given the nature of the activity generally spill levels are kept to a minimum c. 3% to provide cost efficient extraction. Additionally, the potential for cumulative impact with the Transmission Assets is further limited by the orientation of tidal currents within the East Irish Sea which run east to west, thus sediments would move in parallel and not towards each other. No cumulative effect is expected to affect relevant receptors. The cumulative effect on the Fylde MCZ and the Shell Flat and Lune Deep SAC would be characterised by light deposition of a negligible magnitude. **Subtidal habitat IEFs, West of Walney MCZ IEFs, West of Copeland MCZ IEFs, Intertidal habitat IEFs**	

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	indistinguishable from background levels therefore having minimal cumulative impact. The construction phase of the Transmission Assets, the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets also coincides with the maintenance and repair of cables and cable protection of the Isle of Man to UK Interconnector Cable. Additionally, maintenance works may involve the replacement of concrete mattressing cable protection with rock filled filter units. The route of the interconnector runs directly through the Offshore Order Limits and aligns with the north offshore export cable corridor. Thus, is likely that if activities overlap that suspended sediment plumes could interact, as they may originate from a similar source, and have the potential to impact the West of Walney MCZ and West of Copeland MCZ. As with other maintenance activities these would be intermittent and limited in nature and given the Transmission Assets sedimentation is near background levels at the Walney MCZ and West of Copeland MCZ, those from cable maintenance operations are likely to be of a lesser magnitude with limited potential for cumulative impacts at these sites. The Isle of Man to UK Interconnector does however also lie within and in close proximity to Shell Flat and Lune Deep SAC and the Fylde MCZ and here there is	The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs and Shell Flat and Lune Deep SAC IEFs** The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **low**.	

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	greater potential for cumulative impacts at these sites. The magnitude of these impacts would vary greatly depending on the location and scale of reburial operations and also the timing of the work relative to the Transmission Assets. The construction phase of the Transmission Assets and the Mona Offshore Wind Project align with those of the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets. Cumulative impacts are likely to arise between the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets and the Transmission Assets in the unlikely event that seabed preparation, cable installation or foundation installation activities and undertaken simultaneously. Should multiple operations be undertaken in concert, plumes would however, be advected on the tide and not towards one another. These activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration. In both cases the majority of sedimentation would occur within close proximity to each installation however, given the active sediment transport regime deposited material would be redistributed across the vicinity. This cumulative plume may indirectly affect the West of Walney and West of Copeland MCZs with plumes reaching the sites, however, sediment		

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	concentrations are dispersed to well below background variations at these locations and sedimentation levels are negligible. The cumulative effect is expected to directly impact on the Fylde MCZ and indirectly impact the Annex I sandbanks within the Shell Flat and Lune Deep SAC, however this would again be characterised by light deposition of a negligible magnitude. The disposal site associated with the dredging operations at Douglas Harbour is located at the north west extent of the CEA physical processes study area. Due to distance (22.74 km) and the orientation of tidal currents it would not exhibit a cumulative effect with the Transmission Assets with respect to the West of Copeland MCZ and the West of Walney MCZ designated receptors. With suspended sediment plumes running in parallel instead of coalescing. **Subtidal habitat IEFs, West of Walney MCZ IEFs, West of Copeland MCZ IEFs, Intertidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs and Shell Flat and Lune Deep SAC IEFs** The cumulative effect is predicted to be of local spatial extent, short term duration,		

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	intermittent and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **low**.		
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF, the low resemblance stony reef IEF and the seapens and burrowing megafauna communities IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF, the low resemblance stony reef IEF and the seapens and burrowing megafauna communities IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF, the low resemblance stony reef IEF and the seapens and burrowing megafauna communities IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, for the brittlestar beds IEF, the magnitude of the cumulative impact is low and the sensitivity is medium. The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs**

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	Overall, for the brittlestar beds IEF, the magnitude of the cumulative impact is low and the sensitivity is medium. The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is low. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF of the Fylde MCZ is low. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.	Overall, for the brittlestar beds IEF, the magnitude of the cumulative impact is low and the sensitivity is medium. The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is low. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF of the Fylde MCZ is low. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.	Overall, the magnitude of the cumulative impact is low and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is low. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF of the Fylde MCZ is low. The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is low and the sensitivity of subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. **West of Walney MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF is negligible. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. **West of Copeland MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse sediment IEF and the

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This conclusion has been reached due to the high resilience of the characteristic species of the biotopes of this IEF to the relevant pressures. **West of Walney MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **West of Copeland MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse sediment IEF and the subtidal mixed sediment IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low volumes of SSC which will overlap with the West of	Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached due to the high resilience of the characteristic species of the biotopes of this IEF to the relevant pressures. **West of Walney MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **West of Copeland MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse sediment IEF and the subtidal mixed sediment IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low volumes of SSC which will overlap with the West of	subtidal mixed sediment IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	Copeland MCZ only intermittently during the construction phase. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low volumes of SSC which will overlap with the West of Copeland MCZ only intermittently during the construction phase. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.	Copeland MCZ only intermittently during the construction phase. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This was concluded due to the relatively low volumes of SSC which will overlap with the West of Copeland MCZ only intermittently during the construction phase. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.	
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
Operation and Maintenance Phase			
Sensitivity of receptor	The sensitivity of the receptors will be the same as described for the construction phase, and as listed in **section 2.11.3**.		
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 together with the following Tier 1 projects: • Maintenance of Walney Extension 4 Offshore Wind Farm; • Maintenance of Walney Extension 3 Offshore Wind Farm; • Maintenance of Walney 2 Offshore Wind Farm; • Maintenance of Walney 1 Offshore Wind Farm; • Maintenance of Walney export and inter array cables; • Maintenance of West of Duddon Sands Offshore Wind Farm; • Operation and maintenance of the Mona Offshore Wind Project; • Ribble Estuary dredging and dump at sea; and • Maintenance/repair of Isle of Man to UK interconnector and replacement of concrete mattresses used for cable protection with rock filled filter units. If cables repairs are undertaken within a distance 5 km of the Fylde MCZ or Ribble Estuary designated areas, then the magnitude of impact would be as described	The cumulative effects assessment for Scenario 4b considers Scenario 4a together with the following Tier 2 project: • Proposed development of the Mooir Vannin Offshore Wind Farm; • Proposed development of Eni Hynet – Carbon Capture Project; and • Operation of the Westminster Gravels Aggregate Extraction site – Liverpool Bay Area 457. The magnitude of the increase in suspended sediment concentrations arising from maintenance activities during operation and maintenance phase, has been assessed as low for the Transmission Assets, the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets. If cable repairs are undertaken within a distance 5 km of the Fylde MCZ or Ribble Estuary designated areas, then the magnitude of impact would be as described for the construction phase in the previous section. The cumulative effects assessment also considers the proposed development of the Mooir Vannin Offshore Wind Farm. Maintenance activities are both intermittent and a smaller scale than that of the	The cumulative effects assessment for Scenario 4c considers Scenario 4b together with the following Tier 3 projects: • Operation and Maintenance of the Isle of Man to UK Interconnector Cable 2; and • Mooir Vannin – UK Transmission Assets. The operation and maintenance phase of the Transmission Assets and Generation Assets overlaps with the operation and maintenance phase of the Mooir Vannin – UK Transmission Assets. The magnitude of the increase in suspended sediment concentrations arising from maintenance activities during operation and maintenance phase, has been assessed as low for the Transmission Assets and Generation Assets. If cable repairs are undertaken within a distance 5 km of the Fylde MCZ, then the magnitude of impact would be as described for the construction phase in the previous section. Additionally, remobilised and redistributed material may reach the south edges of West of Copeland MCZ, West of Walney MCZ and the Shell Flat feature of the Shell Flat and Lune Deep SAC during certain conditions, namely flood tides coupled with winds from the south west/ west, during which the sediment

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	for the construction phase in the previous section. The operation and maintenance phase, of the Transmission Assets, the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets coincides with the maintenance phases of the Walney 1, Walney 2, Walney Extension 3 and Walney Extension 4 Offshore Wind Farm and associated export and inter array cables and also the West of Duddon Sands Offshore Wind Farm. The magnitude of these impacts are the same as those described for the construction phase however the potential for cumulative impacts is greatly reduced due the limited and intermittent nature of the activities relating to the Transmission Assets maintenance and cable reburial. During this period there will be continued maintenance of the Isle of Man to UK Interconnector which was described in the previous section. As with the Offshore Wind Farm maintenance, the potential magnitude of the cumulative impacts is the same however, the likelihood of occurrence if greatly reduced. The magnitude of the increase in suspended sediment concentrations arising from maintenance activities during operation and maintenance phase, has been assessed as low for the Transmission Assets, the Morgan Offshore Wind Project:	construction phase and therefore any potential cumulative impacts are less likely to occur and be on a smaller scale. There is potential for overlap with the proposed development of the Eni Hynet – Carbon Capture Project during the operation and maintenance phase although as a Tier 2 there is limited data available on the project. Suspended sediments may arise from Eni Hynet – Carbon Capture Project due to associated maintenance works. However, given the distance between the development and the Transmission Assets/Morgan Offshore Wind Project: Generation Assets/Morecambe Offshore Windfarm: Generation Assets and the fact it is located directly to the south, it is not expected that a cumulative increase in SSC or deposition will occur. With suspended sediments instead moving east – west in parallel with those of the Transmission Assets/Morgan Offshore Wind Project: Generation Assets/Morecambe Offshore Windfarm: Generation Assets. There also remains the potential for the operation and maintenance phase of the proposed development to overlap with the operation of the Westminster Gravels Aggregate Extraction Area 457. Both the maintenance activities associated with the Transmission Assets and the processes of aggregate extraction will increase suspended sediment concentrations and thus if carried out simultaneously have the	plume can be exaggerated. However, this would be highly dependent on where cable repair and reburial takes place. Where this sedimentation may occur, it will do so in depths indistinguishable from background levels due to the receptors being situated *c*. 6 km from the Offshore Order Limits. The operation and maintenance phase of the Transmission Assets and Generation Assets overlaps with the operation and maintenance phase of the Isle of Man to UK interconnector 2. The magnitude of impact associated with operation and maintenance activities associated with the Isle of Man to UK Interconnector Cable 2, can be expected to be similar to those of reburial/repair activities associated with the Transmission Assets. Therefore, dependent on the detailed design and cable routing associated with the interconnector cable, a cumulative impact may arise with the Transmission Assets and Generation Assets with respect to the West of Copeland MCZ and the West of Walney MCZ designated receptors. As a Tier 3 project there is very limited information available in this respect, however it is anticipated that this impact would be temporary in nature and of limited scale. The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	Generation Assets and the Morecambe Offshore Windfarm: Generation Assets. Both the Transmission Assets, the Morgan Offshore Wind Project: Generation Assets, the Morecambe Offshore Windfarm: Generation Assets and the Mona Offshore Wind Project are on the same construction schedule and therefore both sites would be in the operation and maintenance phase at the same time. Potential cumulative impacts may relate to cable repair and reburial at either site. However, maintenance activities are both intermittent and a smaller scale than that of the construction phase and therefore any potential cumulative impacts are less likely to occur and be on a smaller scale. The location of the Mona Offshore Wind Project to the south of the Transmission Assets means that no cumulative effects occur for the designated areas associated with the Transmission Assets. As described in Scenario 3, a small cumulative change in SSC and deposition is expected between the Transmission Assets, Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets during the maintenance phase if maintenance activities are undertaken concurrently. However, as for the construction phase this would fall within natural variation in background levels of sedimentation and is not significant.	ability to create a cumulative impact; although the contribution from extraction activities will depend largely on the volume and method used to remove material. Given the nature of the activity generally spill levels are kept to a minimum c. 3% to provide cost efficient extraction. Additionally, the potential for cumulative impact with the Transmission Assets is further limited by the orientation of tidal currents within the East Irish Sea which run east to west, thus sediments would move in parallel and not towards one another. No cumulative effect is expected to affect relevant receptors. The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.	

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.		
Significance of effect	**Subtidal habitats IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF, the low resemblance stony reef IEF and the seapens and burrowing megafauna communities IEF is negligible to the pressure associated with this impact. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the brittlestar beds IEF, the magnitude of the cumulative impact is negligible and the sensitivity is medium. The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms.	**Subtidal habitats IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF and the low resemblance stony reef IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the brittlestar beds IEF, the magnitude of the cumulative impact is negligible and the sensitivity is medium. The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs**	**Subtidal habitats IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF and the low resemblance stony reef IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the brittlestar beds IEF, the magnitude of the cumulative impact is negligible and the sensitivity is medium. The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs**

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	Shell Flat and Lune Deep SAC IEFs Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ is low and negligible respectively. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **West of Walney MCZ IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. **West of Copeland MCZ IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal coarse sediment IEF and the subtidal mixed sediment IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF and subtidal mud IEF of the Fylde MCZ is low and negligible respectively. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **West of Walney MCZ IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. **West of Copeland MCZ IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal coarse sediment IEF and the subtidal mixed sediment IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF and subtidal mud IEF of the Fylde MCZ is low and negligible respectively. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **West of Walney MCZ IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. **West of Copeland MCZ IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal coarse sediment IEF and the subtidal mixed sediment IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. **Intertidal habitats IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant.	Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **Intertidal habitats IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the subtidal sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **Intertidal habitats IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		
Decommissioning Phase			
Sensitivity of receptor	The sensitivity of the receptors will be the same as described for the construction phase, and as listed in **section 2.11.3**.		
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 together with the following Tier 1 projects: • Mona Offshore Wind Project decommissioning structures.	The cumulative effects assessment for Scenario 4b considers Scenario 4a together with the following Tier 2 project: • Proposed development of the Mooir Vannin Offshore Wind Farm; and	There are no Tier 3 developments considered within the CEA which have a temporal overlap with the decommissioning phase of the Transmission Assets.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	Following decommissioning of the Transmission Assets, the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets, changes to tidal regime would be of lesser magnitude than the operation and maintenance phase, as no structures would remain in the water column to influence tidal flow, with only the scour and cable protection retained within the context of the MDS. Similarly, any additional cable protection provided within or at close proximity to designated area due to the Isle of Man Interconnector may continue to influence the tidal flow, however due to spacing they have no cumulative impact on designated areas or adjacent shorelines. The magnitude of the increase in suspended sediment concentrations arising from the removal of Transmission Assets, particularly cabling, has been assessed as low. As for the construction phase, remobilised and redistributed material may reach the south edges of West of Copeland MCZ, West of Walney MCZ and Shell Flat feature of the Shell Flat and Lune Deep SAC in depths indistinguishable from background levels. There is potential for a cumulative effect to occur during the decommissioning of the Isle of Man Offshore Wind Farm, however, given the alignment of the site and the north east to south west orientation of the tidal flow at this location, sediment plumes	• Proposed development of Eni Hynet – Carbon Capture Project. The magnitude of the increase in suspended sediment concentrations arising from the removal of Transmission Assets, particularly cabling, has been assessed as low. As for the construction phase, remobilised and redistributed material may reach the south edges of West of Copeland MCZ, West of Walney MCZ and Shell Flat feature of the Shell Flat and Lune Deep SAC in depths indistinguishable from background levels. There is potential for a cumulative effect to occur during the decommissioning of the Mooir Vannin Offshore Wind Farm, however, given the alignment of the site and the north east to south west orientation of the tidal flow at this location, sediment plumes and subsequent sedimentation would have limited overlap. There is potential for overlap with the proposed development of the Eni Hynet – Carbon Capture Project during the operation and maintenance phase although as a Tier 2 project there is limited data available. Suspended sediments may arise from Eni Hynet – Carbon Capture Project due to associated decommissioning works. However, given the distance between the development and the Transmission Assets/Morgan Offshore Wind Project: Generation Assets/Morecambe Offshore Windfarm: Generation Assets, and the fact it is located directly to the south, it is not	

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	and subsequent sedimentation would have limited overlap. Any cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. The magnitude of impact is therefore, considered to be low adverse and limited to West of Copeland MCZ. The impact is therefore predicted to be of local spatial extent and long term duration continuous and high reversibility. The magnitude of impact is therefore **low** in line with the Transmission Assets alone.	expected that a cumulative increase in SSC or deposition will occur. With suspended sediments instead moving east – west in parallel with those of the Transmission Assets/Morgan Offshore Wind Project: Generation Assets/Morecambe Offshore Windfarm: Generation Assets. This is further mitigated by the fact decommissioning activities of the Eni – Hynet Carbon Capture Project are likely to be very limited. Any cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. The magnitude of impact is therefore, considered to be low adverse and limited to West of Copeland MCZ. The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was	No Tier 3 projects were identified as overlapping the decommissioning phase; therefore this assessment will be the same as for Scenario 4b.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF, the low resemblance stony reef IEF and the seapens and burrowing megafauna communities IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. Overall, for the brittlestar beds IEF, the magnitude of the cumulative impact is low and the sensitivity is medium. The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is low. The cumulative effect will, therefore, be of	concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF, the low resemblance stony reef IEF and the seapens and burrowing megafauna communities IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. Overall, for the brittlestar beds IEF, the magnitude of the cumulative impact is low and the sensitivity is medium. The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is low. The cumulative effect will, therefore, be of	

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	minor adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF of the Fylde MCZ is low. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This conclusion has been reached due to the high resilience of the characteristic species of the biotopes of this IEF to the relevant pressures. **West of Walney MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse	**minor** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF of the Fylde MCZ is low. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached due to the high resilience of the characteristic species of the biotopes of this IEF to the relevant pressures. **West of Walney MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF, the subtidal mud IEF and the seapens and burrowing megafauna IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse	

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **West of Copeland MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse sediment IEF and the subtidal mixed sediment IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low volumes of SSC which will overlap with the West of Copeland MCZ only intermittently during the construction phase. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low volumes of SSC which will overlap with the West of Copeland MCZ only intermittently during the construction phase. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium*	significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments. **West of Copeland MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal coarse sediment IEF and the subtidal mixed sediment IEF is low. The cumulative effect will, therefore, be of **negligible** adverse significance which is not significant in EIA terms. This was concluded due to the relatively low volumes of SSC which will overlap with the West of Copeland MCZ only intermittently during the construction phase. Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This was concluded due to the relatively low volumes of SSC which will overlap with the West of Copeland MCZ only intermittently during the construction phase. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the species poor/barren sands IEF, the polychaete/bivalve-dominated muddy sand shores IEF and the *Echinocardium*	

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	cordatum and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.	*cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This was concluded due to the relatively low levels of SSC which will dissipate to background levels within 5 km in most cases, and which will be similar to existing sediments.	
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

2.13.4 Long term habitat loss

2.13.4.1 Long term habitat loss is predicted to occur as a result of the presence of the Transmission Assets, Morgan Offshore Wind Project: Generation Assets, Morecambe Offshore Windfarm: Generation Assets, and a range of nearby Tier 1, Tier 2 and Tier 3 offshore wind farm projects and infrastructure projects, with the long term habitat loss occurring as a result of the physical presence of foundations, scour protection and cable protection.

2.13.4.2 Three Tier 1 (Awel Y Môr Offshore Windfarm, Mona Offshore Wind Project and Isle of Man Crogga Licence), two Tier 2 projects (Mooir Vannin Offshore Windfarm and Eni Hynet CCS) and three Tier 3 projects have been identified (MaresConnect, the Isle of Man UK Interconnector 2 and the Mooir Vannin – UK Transmission Assets) have been identified within the CEA benthic subtidal and intertidal ecology study area.

2.13.4.3 The cumulative impact of scenarios 1-3 are presented in **Table 2.31** and for scenarios 4a-4c in **Table 2.32**.

Table 2.31: Cumulative long term habitat loss (Scenarios 1-3)

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
Construction and Operation and Maintenance Phase			
Sensitivity of receptor	The sensitivity of the subtidal habitat IEFs to long term habitat loss is as described previously for the construction phase assessment for the Transmission Assets alone in **paragraphs 2.11.5.4** to **2.11.5.9**. **Subtidal habitat IEFs** The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore considered to be **high**. The brittlestar bed IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Transmission Assets; and • The Morecambe Offshore Windfarm: Generation Assets. The installation of infrastructure for both of these projects would result in up to 1.09 km^2 of long term habitat loss/habitat alteration.	The cumulative effects assessment for Scenario 2 considers the following: • The Transmission Assets; and • The Morgan Offshore Wind Project: Generation Assets. The installation of infrastructure for both of these projects would result in up to 1.89 km^2 of long term habitat loss/habitat alteration.	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets; • The Morecambe Offshore Windfarm: Generation Assets; and • The Morgan Offshore Wind Project: Generation Assets. The installation of infrastructure for these projects would result in up to 2.40 km^2 of

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	This includes all of the subtidal long term habitat loss (or habitat alteration) associated with the Transmission Assets together with up to 0.51 km^2 of long term loss associated with the Morecambe Offshore Windfarm: Generation Assets (Morecambe Offshore Windfarm Ltd, 2024a). **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	This includes all of the subtidal long term habitat loss associated with the Transmission Assets together with up to 1.31 km^2 of long term loss associated with the foundations and cable/scour protection associated with the Morgan Offshore Wind Project: Generation Assets (Morgan Offshore Wind Ltd, 2023). **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	long term habitat loss/habitat alteration. This does not represent a significant increase in the area of long term habitat loss compared to each scenario separately. **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.
Significance of effect	**Subtidal habitat IEFs** Overall, for the subtidal habitat IEFs the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. The cumulative long term habitat loss will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function.	**Subtidal habitat IEFs** Overall, for the subtidal habitat IEFs the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. The cumulative long term habitat loss will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function.	**Subtidal habitat IEFs** Overall, for the subtidal habitat IEFs the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. The cumulative long term habitat loss will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function.

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		
Decommissioning Phase			
Sensitivity of receptor	The sensitivity of all receptors will be the same as in the construction phase and operation and maintenance phase, and as listed in **section 2.11.5**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Transmission Assets; and • The Morecambe Offshore Windfarm: Generation Assets. The infrastructure remaining on the seabed following the decommissioning of both projects would result in up to 1.09 km^2 of permanent habitat loss/habitat alteration, This includes all of the subtidal permanent habitat loss/habitat alteration associated with the Transmission Assets together with up to 0.51 km^2 of potentially permanent habitat loss (on the basis that it is currently unknown whether structures associated with the project would be removed at the point of decommissioning) associated with the Morecambe Offshore Windfarm: Generation Assets (Morecambe Offshore Windfarm Ltd, 2024a). **Subtidal habitat IEFs**	The cumulative effects assessment for Scenario 2 considers the following: • The Transmission Assets; and • The Morgan Offshore Wind Project: Generation Assets. The infrastructure remaining on the seabed following the decommissioning of both projects would result in up to 1.83 km^2 of permanent habitat loss/habitat alteration, This includes all of the subtidal permanent habitat loss/habitat alteration associated with the Transmission Assets together with up to 1.25 km^2 of permanent habitat loss/alteration associated with the Morgan Offshore Wind Project: Generation Assets (Morgan Offshore Wind Ltd, 2023). **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets; • The Morecambe Offshore Windfarm: Generation Assets; and • The Morgan Offshore Wind Project: Generation Assets. The infrastructure remaining on the seabed following the decommissioning of these projects would result in up to 2.34 km^2 of permanent habitat loss/habitat alteration. This does not represent a significant increase in the area of long term habitat loss compared to each scenario separately. **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	receptor directly. The magnitude is therefore, considered to be **low**.	
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. The cumulative long term habitat loss will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. The cumulative long term habitat loss will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. The cumulative long term habitat loss will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

Table 2.32: Cumulative long term habitat loss (Scenarios 4a-4c)

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
Construction and Operation and Maintenance Phase			
Sensitivity of receptor	The sensitivity of the subtidal habitat IEFs and Fylde MCZ IEFs to long term habitat loss is as described previously for the construction phase assessment for the Transmission Assets alone in **paragraphs 2.11.5.4** to **2.11.5.12**. **Subtidal habitat IEFs** The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The brittlestar bed IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. **Fylde MCZ IEFs** The subtidal sand IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal mud IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.		
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 (Transmission Assets, Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets) together with the following Tier 1 projects: • Awel y Môr Offshore Windfarm; • Mona Offshore Wind Project;	The cumulative effects assessment for Scenario 4b considers Scenario 4a together with the following Tier 2 projects: • Mooir Vannin Offshore Windfarm; and • Eni Hynet CCS. The amount of long term habitat loss/habitat alteration from the Mooir Vannin Offshore Windfarm has not yet been quantified, however it is likely to result	The cumulative effects assessment for Scenario 4c considers Scenario 4b together with the following Tier 3 projects: • MaresConnect; • Isle of Man – UK Interconnector 2 • Mooir Vannin – UK Transmission Assets. There is currently very little information on the impact that these cable projects will

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	• Isle of Man Crogga Licence; and • Isle of Man to UK Interconnector Cable maintenance licences (MLA/2016/00211). Mona Offshore Wind Project will result 2.19 km^2 of long term habitat loss/habitat alteration from wind turbine and OSP foundations, scour protection and cable protection (Mona Offshore Project Ltd, 2024). Awel y Môr Offshore Windfarm is predicted to result in 1.07 km^2 of long term habitat loss/habitat alteration as a result of wind turbine and OSP foundations, scour protection, met masts, cable protection and cable crossings. This tier also includes the Crogga oil and gas exploration licence to drill an appraisal well. No quantification regarding the impact of this activity has been published however based on the nature of the work it is likely that activities such as the installation of a well head and any discarded drill cuttings may result in long term habitat loss (Isle of Man Government, 2021). Cable protection, the deposition of rock or concrete mattresses, may potentially need to be installed for the Isle of Man - UK Interconnector 1 as part of maintenance activities for this project including within the Fylde MCZ. The MDS assumes a maximum of 2 km of cable would be covered either with 333 mattresses along a narrow corridor (3 m wide) covering a total area of	from wind turbine foundations and cable and scour protection (Mooir Vannin Offshore Windfarm Ltd, 2023). A scoping report for the ENI Hynet CCS suggest that long term subtidal habitat loss/habitat alteration could occur directly under the newly installed cable route with rock armouring/protection in place (Liverpool Bay CCS Ltd, 2022). The Transmission Assets, Morgan Offshore Wind Project: Generation Assets, Morecambe Offshore Windfarm: Generation Assets, Tier 1 and Tier 2 projects may result an increase in long term habitat loss compared to Tier 1 alone however this value cannot be quantified. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** There are no tier 2 projects which spatially overlap with the Fylde MCZ, therefore no tier 2 assessment of the impact on the Fylde MCZ is required.	have on benthic ecology receptors however the infrastructure associated with these projects, which may result in long term habitat loss/habitat alteration will be similar to that described for the installation of cables for the Transmission Assets (i.e. cable protection and cable crossings). For the Mooir Vannin – UK Transmission Assets long term habitat loss/alteration may also arise from the booster station (Mooir Vannin Offshore Wind Farm Ltd., 2024). As Tier 3 projects there is limited information available in this respect, however it is anticipated that this impact would be localised and of limited scale. There is the potential for both the Isle of Man – UK Interconnector 2 and the Mooir Vannin – UK Transmission Assets to overlap with the Fylde MCZ and result in long term habitat loss/alteration of the designated features. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	seabed 1,000 m^2 or 12,400 tons of rock would be deposited along a corridor approximately 5 m wide (Manx Utilities Ltd, 2017). If cable protection is required within the Fylde MCZ The MDS is for a 1.2 km section of the cable which could result in up to 0.00624 km^2 of long term habitat loss (Manx Utilities Ltd, 2017). The Transmission Assets, Morgan Offshore Wind Project: Generation Assets, Morecambe Offshore Windfarm: Generation Assets and Tier 1 projects may result in up to 5.66 km^2 of long term habitat loss. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.		receptor directly. The magnitude is therefore, considered to be **low**.
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	minor adverse significance, which is not significant in EIA terms. The cumulative long term habitat loss will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and sensitivity of the receptor is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact in terms of area and proportion of the MCZ affected.	**minor** adverse significance, which is not significant in EIA terms. The cumulative long term habitat loss will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function.	**minor** adverse significance, which is not significant in EIA terms. The cumulative long term habitat loss will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and sensitivity of the receptor is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact in terms of area and proportion of the MCZ affected.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		
Decommissioning Phase			
Sensitivity of receptor	The sensitivity of all receptors will be the same as in the construction phase, and as listed in **section 2.11.5**.		
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 (Transmission Assets, Morgan Offshore Wind Project: Generation Assets, Morecambe Offshore Windfarm: Generation Assets) together with the following Tier 1 project:	The cumulative effects assessment for Scenario 4b considers Scenario 3 together with all Tier 1 projects and the following Tier 2 projects: • Mooir Vannin Offshore Windfarm.	The cumulative effects assessment for Scenario 4c considers Scenario 3 together with all Tier 1 and 2 projects and the following Tier 3 project: • Mooir Vannin – UK Transmission Assets.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	• Mona Offshore Wind Project. The Mona Offshore Wind Project will also be in its decommissioning phase which may result in 2.14 km^2 of infrastructure being left *in situ* such as scour protection and cable protection Mona Offshore Wind Ltd, 2024). The Transmission Assets, Morgan Offshore Wind Project: Generation Assets, Morecambe Offshore Windfarm: Generation Assets and Tier 1 projects may result in up to 4.48 km^2 of long term habitat loss. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	The details of the Mooir Vannin Isle of Man wind farm lease area are not currently available but are unlikely to represent a significant increase in the area of hard substrates introduced beyond all other projects considered. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	There is currently very little information on the impact that this cable project will have on benthic ecology receptors however the infrastructure associated with these projects which may result in long term habitat loss/habitat alteration will be similar to that described for the installation of cables for the Transmission Assets (i.e. cable protection and cable crossings) with the potential addition of a booster station for the Mooir Vannin – UK Transmission Assets (Mooir Vannin Offshore Wind Farm Ltd., 2024). As a Tier 3 project there is limited information available in this respect, however it is anticipated that this impact would be localised and of limited scale. There is the potential for the Mooir Vannin – UK Transmission Assets to overlap with the Fylde MCZ and result in long term habitat loss/alteration of the designated features **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
			receptor directly. The magnitude is therefore, considered to be **low**.
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. The cumulative long term habitat loss will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. The cumulative long term habitat loss will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. The cumulative long term habitat loss will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and sensitivity of the receptor is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant. This conclusion has been largely based on the small scale of this impact in terms of area and proportion of the MCZ affected.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

2.13.5 Introduction of artificial structures

2.13.5.1 The introduction of artificial structures into areas of predominantly soft sediments, as a result of multiple plans and projects, has the potential to alter community composition and biodiversity within the CEA benthic subtidal and intertidal ecology study area.

2.13.5.2 The Transmission Assets have been assessed against the Morecambe Offshore Windfarm and Morgan Offshore Wind Project: Generation Assets in scenarios 1-3 in **Table 2.33**.

2.13.5.3 Three projects were screened into the Tier 1 assessment for cumulative effects from the introduction of artificial structures, with two screened in for the Tier 2 assessment, and a further three screened in for the tier 3 assessment. These projects are listed and assessed cumulatively in **Table 2.34**.

Table 2.33: Cumulative effect of introduction of artificial structures (Scenarios 1-3)

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
Construction and Operation and Maintenance Phase			
Sensitivity of receptor	The sensitivity of the subtidal habitat IEFs and Fylde MCZ IEFs to long term habitat loss is as described previously for the construction phase assessment for the Transmission Assets alone in **paragraphs 2.11.6.3** to **2.11.6.12**. **Subtidal habitat IEFs** The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The brittlestar beds IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Transmission Assets; and • The Morecambe Offshore Windfarm: Generation Assets. These two projects may result in up to 1.09 km^2 of artificial structures. These two projects include all of the subtidal artificial structures associated with the Transmission Assets together with up to 0.51 km^2 of artificial structures associated	The cumulative effects assessment for Scenario 2 considers the following: • The Transmission Assets; and • The Morgan Offshore Wind Project: Generation Assets. These two projects may result in up to 2.37 km^2 of artificial structures. These two projects include all of the subtidal artificial structures associated with the Transmission Assets together with up to 1.79 km^2 of artificial structures associated	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets; • The Morecambe Offshore Windfarm: Generation Assets; and • The Morgan Offshore Wind Project: Generation Assets. These three projects may result in up to 2.88 km^2 of artificial structures. These three projects do not represent a significant increase in introduced artificial

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	with the Morecambe Offshore Windfarm: Generation Assets (Morecambe Offshore Windfarm Ltd, 2024a). **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	with the Morgan Offshore Wind Project: Generation Assets (Morgan Offshore Wind Ltd, 2023). **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	structures compared to each scenario separately. The cumulative assessment of the impact of the Transmission Assets in combination with the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets would not result in a notable change to the magnitude of the impact such that the magnitude would rise from low to medium. **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion has been reached because of the localised extent of the impact, the large area over which this potential impact is dispersed.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion has been reached because of the localised extent of the impact, the large area over which this potential impact is dispersed.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion has been reached because of the localised extent of the impact, the large area over which this potential impact is dispersed.

	Scenario 1: **Transmission Assets + Morecambe Offshore Windfarm: Generation Assets**	**Scenario 2:** **Transmission Assets + Morgan Offshore Wind Project: Generation Assets**	**Scenario 3:** **Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets**
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		
Decommissioning Phase			
Sensitivity of receptor	The sensitivity of all receptors will be the same as in the construction and operation and maintenance phase, and as listed in **section 2.11.6**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Transmission Assets; and • The Morecambe Offshore Windfarm: Generation Assets. This impact is not assessed for the Morecambe Offshore Windfarm: Generation Assets in the decommissioning phase however given the limited interactions, localised nature and small scale of effects (Morecambe Offshore Windfarm Ltd, 2024a) the cumulative significance of these impacts is not considered to be elevated beyond the project alone assessment for the Transmission Assets. **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the	The cumulative effects assessment for Scenario 2 considers the following: • The Transmission Assets; and • The Morgan Offshore Wind Project: Generation Assets. These two projects may result in up to 1.83 km² of artificial structures. These two projects include all of the subtidal artificial structures associated with the Transmission Assets together with up to 1.25 km² of artificial structures associated with the Morgan Offshore Wind Project: Generation Assets (Morgan Offshore Wind Ltd, 2023). **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets; • The Morecambe Offshore Windfarm: Generation Assets; and • The Morgan Offshore Wind Project: Generation Assets. These three projects may result in up to 1.83 km² of artificial structures. These three projects do not represent a significant increase in introduced artificial structures compared to each scenario separately. Cumulatively assessing the impact of the Transmission Assets in combination with the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets, as in the long term habitat loss impact would not result in a notable change to the extent of the impact

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	receptor directly. The magnitude is therefore, considered to be **low**.		such that the magnitude would rise from low to medium. **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion has been reached because of the localised extent of the impact, the large area over which this potential impact is dispersed.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion has been reached because of the localised extent of the impact, the large area over which this potential impact is dispersed.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion has been reached because of the localised extent of the impact, the large area over which this potential impact is dispersed.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

Table 2.34: Cumulative effect of introduction of artificial structures (Scenarios 4a-4c)

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
Operation and maintenance phase			
Sensitivity of receptor	The sensitivity of the subtidal habitat IEFs and Fylde MCZ IEFs to long term habitat loss is as described previously for the construction phase assessment for the Transmission Assets alone in **paragraphs 2.11.6.3** to **2.11.6.12**. **Subtidal habitats IEFs** The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The brittlestar beds IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. **Fylde MCZ IEFs** The subtidal sand IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal mud IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.		
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 (Transmission Assets, Morgan Offshore Wind Project: Generation Assets, and Morecambe Offshore Windfarm: Generation Assets) together with the following Tier 1 projects: • Awel y Môr Offshore Wind Farm; • Mona Offshore Wind Farm;	The cumulative effects assessment for Scenario 4b considers Scenario 4a together with the following Tier 2 projects: • Mooir Vannin Offshore Windfarm; and • Eni Hynet CCS. The amount of artificial infrastructure which may be installed as a result of the Mooir Vannin Offshore Windfarm has not yet been quantified, however it is likely to result	The cumulative effects assessment for Scenario 4c considers Scenario 4b together with the following Tier 3 projects: • MaresConnect; • Isle of Man – UK Interconnector 2; • Mooir Vannin – UK Transmission Assets. There is currently very little information on the impact that these cable projects will

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	• Isle of Man Crogga Licence; and Isle of Man to UK Interconnector Cable maintenance licences (MLA/2016/00211).The Mona Offshore Wind Project is likely to result in the introduction of 2.19 km^2 of hard substrate from wind turbine and OSP foundations, scour protection, cable protection and cable crossings (Mona Offshore Wind Project Ltd, 2024). Awel y Môr Offshore Wind Farm is likely to result in 1.07 km^2 of hard substrate from wind turbine and OSP foundations, scour protection, met masts, cable protection and cable crossings (RWE, 2023). This tier also includes the Crogga oil and gas exploration licence to drill an appraisal well. No quantification regarding the impact of this activity has been published and detail is limited. however based on the nature of the work it is likely that activities such as the installation of a well head and any discarded drill cuttings may result in introduction of artificial structures and materials (Isle of Man Government, 2021). Cable protection, the deposition of rock or concrete mattresses, may potentially need to be installed for the Isle of Man - UK Interconnector 1 as part of maintenance activities for this project including within the Fylde MCZ. In the MDS assumes a maximum of 2 km of cable would be covered either with 333 mattresses along a narrow corridor (3 m wide) covering a total	from wind turbine foundations and cable and scour protection (Mooir Vannin Offshore Windfarm Ltd, 2023). A scoping report for the ENI Hynet CCS suggests that artificial structures could be installed in the form of cable protection (Liverpool Bay CCS Ltd, 2022). The details of the Mooir Vannin Isle of Man wind farm lease area are not currently available but are unlikely to represent a significant increase in the area of hard substrates introduced beyond all other projects considered. The Transmission Assets, Morgan Offshore Wind Project: Generation Assets, Morecambe Offshore Windfarm: Generation Assets, Tier 1 and Tier 2 projects may result an increase in introduced artificial structures compared to Tier 1 alone however this value cannot be quantified. **Subtidal IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** There are no tier 2 projects which spatially overlap with the Fylde MCZ, therefore no tier 2 assessment of the impact on the Fylde MCZ is required.	have on benthic ecology receptors however it is likely that artificial structures will be introduced in relation to the cables that may be similar to what is described for cables for the Transmission Assets (i.e. cable protection and cable crossings). For the Mooir Vannin – UK Transmission Assets there is also the potential for the introduction of artificial structures associated with the potential booster station (Mooir Vannin Offshore Wind Farm Ltd., 2024). There is the potential for both the Isle of Man – UK Interconnector 2 and the Mooir Vannin – UK Transmission Assets to overlap with the Fylde MCZ and potentially result in the introduction of artificial structures within the designated site. **Subtidal IEFs** The cumulative impact is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	area of seabed 1,000 m2 or 12,400 tons of rock would be deposited along a corridor approximately 5 m wide (Manx Utilities Ltd, 2017). If cable protection is required within the Fylde MCZ The MDS is for a 1.2 km section of the cable which could result in up to 0.00624 km2 of long term habitat loss (Manx Utilities Ltd, 2017). The Transmission Assets, Morgan Offshore Wind Project: Generation Assets, Morecambe Offshore Windfarm: Generation Assets and Tier 1 projects may result in the introduction of up to 6.15 km^2 of artificial structures. **Subtidal IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.		
Significance of effect	**Subtidal habitats IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the	**Subtidal habitats IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the	**Subtidal habitats IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion has been reached because of the localised extent of the impact, the large area over which this potential impact is dispersed. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the Fylde MCZ IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion has been largely based on the small scale of this impact in terms of area affected.	subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion has been reached because of the localised extent of the impact, the large area over which this potential impact is dispersed.	subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion has been reached because of the localised extent of the impact, the large area over which this potential impact is dispersed. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the Fylde MCZ IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion has been largely based on the small scale of this impact in terms of area affected.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		
Decommissioning phase			
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 (Transmission Assets, Morgan Offshore Wind Project: Generation Assets, Morecambe Offshore Windfarm: Generation Assets) together with the following Tier 1 project: • Mona Offshore Wind Project. The Mona Offshore Wind Project will also be in its decommissioning phase which may result in 2.14 m^2 of infrastructure being left *in situ* such as scour protection and	The cumulative effects assessment for Scenario 4b considers Scenario 3 together with all Tier 1 projects and the following Tier 2 project: • Mooir Vannin Offshore Windfarm. The details of the Mooir Vannin Isle of Man wind farm lease area are not currently available but are unlikely to represent a significant increase in the area of hard substrates introduced beyond all other projects considered.	The cumulative effects assessment for Scenario 4c considers Scenario 3 together with all Tier 1 and 2 projects and the following Tier 3 project: • Mooir Vannin – UK Transmission Assets. There is currently very little information on the impact this cable project will have on benthic ecology receptors however it is likely that any artificial structures that are introduced in relation to the cables may be similar to what is described for cables for

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	cable protection Mona Offshore Wind Ltd, 2024). The Transmission Assets, Morgan Offshore Wind Project: Generation Assets, Morecambe Offshore Windfarm: Generation Assets and Tier 1 projects may result in up to 3.96 km^2 of long term habitat loss. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	**Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	the Transmission Assets (i.e. cable protection and cable crossings). For the Mooir Vannin – UK Transmission Assets artificial structures may also be introduced as a result of the offshore booster station (Mooir Vannin Offshore Wind Farm Ltd., 2024). **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.
Sensitivity of receptor	The sensitivity of all receptors will be the same as in the construction phase, and as listed in **section 2.11.6**.		
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. The cumulative introduction of artificial structures will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. The cumulative introduction of artificial structures will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. The cumulative introduction of artificial structures will only affect a small proportion of the total area of these IEFs in the Transmission Assets, which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising communities or perform their ecosystem function

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

2.13.6 Increased risk of introduction and spread of INNS

2.13.6.1 Cumulative increased risk of introduction or spread of INNS may result from the physical presence of infrastructure as well as increased boat activity in the region associated with other projects. Cumulative increased risk of introduction and spread of INNS in predicted to occur as a result of the presence of the Transmission Assets and the Morecambe Offshore Windfarm and Morgan Offshore Wind Project: Generation Assets, and these are assessed in scenarios 1-3 in **Table 2.35**.

2.13.6.2 Three projects were screened into the Tier 1 assessment for cumulative effects from the introduction of artificial structures, with one screened in for the Tier 2 assessment, and a further three screened in for the Tier 3 assessment. These projects are listed and assessed cumulatively in **Table 2.36**.

Table 2.35: Cumulative impact of increased risk of introduction and spread of INNS (Scenario 1-3)

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
Construction and Operation and Maintenance Phase			
Sensitivity of receptor	The sensitivity of the subtidal habitat IEFs to increased risk of introduction and spread of INNS is as described previously for the construction phase assessment for the Transmission Assets alone in **paragraphs 2.11.7.4** to **2.11.7.14.** **Subtidal habitat IEFs** The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The brittlestar beds IEF is deemed to be of medium vulnerability, low recoverability, and national importance. The sensitivity of the receptor is **medium**. The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Transmission Assets; and • The Morecambe Offshore Windfarm: Generation Assets. The installation of infrastructure for both of these projects would result in up to 1.09 km^2 of long term habitat loss/habitat alteration. This includes all of the subtidal long term habitat creation associated with the	The cumulative effects assessment for Scenario 2 considers the following: • The Transmission Assets; and • The Morgan Offshore Wind Project: Generation Assets. The installation of infrastructure for both of these projects would result in up to 2.37 km^2 of habitat creation. This includes all of the subtidal habitat creation associated with the Transmission Assets together with up to 1.31 km^2 of	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets; • The Morecambe Offshore Windfarm: Generation Assets; and • The Morgan Offshore Wind Project: Generation Assets. The installation of infrastructure for these projects would result in up to 2.88 km^2 of habitat creation. This does not represent a significant increase in the area of habitat

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	Transmission Assets together with up to 0.51 km^2 of long term habitat creation associated with the Morecambe Offshore Windfarm: Generation Assets (Morecambe Offshore Windfarm Ltd, 2024a). The movements of vessels throughout the construction and operation and maintenance phases could also introduce INNS from ballast water or hulls. The MDS for the Transmission Assets assumes that there may be up to 286 vessel round trips during the construction phase and up to 77 vessel return trips per year during the 35 year operation and maintenance phase. For the Morecambe Offshore Windfarm: Generation Assets there may be up to 150 vessel round trips for the delivery of main components during the construction phase and up to 2,778 return trips for support vessels. During the operation and maintenance phase there may be up to 776 return vessel trips per year (Morecambe Offshore Windfarm Ltd, 2024a). **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	habitat creation associated with the foundations and cable/scour protection associated with the Morgan Offshore Wind Project: Generation Assets (Morgan Offshore Wind Ltd, 2023). The movements of construction and operation and maintenance vessels could also introduce INNS from ballast water or hulls. The MDS for the Transmission Assets assumes that there may be up to 286 vessel round trips during the construction phase and up to 77 vessel return trips per year during the 35 year operation and maintenance phase. For the Morgan Offshore Wind Project: Generation Assets there may be up to 1,878 vessel round trips during the construction phase and up to 1,970 vessels return trips per year during the operation and maintenance phase (Morgan Offshore Wind Ltd, 2023). **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	creation compared to each scenario separately. Cumulatively assessing the impact of the Transmission Assets in combination with the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets would not result in a notable change to the extent of the impact such that the magnitude would rise from low to medium. Vessel activity would largely be focussed in different areas and would be spread over a period of years such that the elevation associated with each project would be indistinguishable from each other. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is medium to high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion was reached due to the relatively small proportion of hard substate which may be introduced during the construction phase, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore, measures have been adopted (**Table 2.11**). as part of the Transmission Assets to minimise the effects from introduction or spread of INNS.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is medium to high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion was reached due to the relatively small proportion of hard substate which may be introduced during the construction phase, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore, measures have been adopted (**Table 2.11**). as part of the Transmission Assets to minimise the effects from introduction or spread of INNS.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is medium to high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion was reached due to the relatively small proportion of hard substate which may be introduced during the construction phase, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore, measures have been adopted (**Table 2.11**). as part of the Transmission Assets to minimise the effects from introduction or spread of INNS.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		
Decommissioning Phase			
Sensitivity of receptor	The sensitivity of all receptors will be the same as in the construction and operation and maintenance phase, and as listed in **section 2.11.7**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Transmission Assets; and	The cumulative effects assessment for Scenario 2 considers the following: • The Transmission Assets; and	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets;

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	• The Morecambe Offshore Windfarm: Generation Assets. This impact is not assessed for the Morecambe Offshore Windfarm: Generation Assets in the decommissioning phase however given the limited interactions, localised nature and small scale of effects (Morecambe Offshore Windfarm Ltd, 2024a) the cumulative significance of these impacts is not considered to be elevated beyond the project alone assessment for the Transmission Assets. Decommissioning vessels could also introduce INNS from ballast water or hulls. The number of vessel movements required are likely to be similar to that described for the construction phase. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	• The Morgan Offshore Wind Project: Generation Assets. The infrastructure remaining on the seabed following the decommissioning of both projects would result in up to 1.83 km^2 of habitat creation. This includes all of the habitat creation associated with the Transmission Assets together with up to 1.25 km^2 of permanent habitat creation associated with the Morgan Offshore Wind Project: Generation Assets (Morgan Offshore Wind Ltd, 2023). The movements of decommissioning vessels could also introduce INNS from ballast water or hulls. The number of vessel movements required are likely to be similar to that described for the construction phase. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	• The Morecambe Offshore Windfarm: Generation Assets; and • The Morgan Offshore Wind Project: Generation Assets. The infrastructure remaining on the seabed following the decommissioning of these projects would result in up to 1.83km^2 of habitat creation. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is medium to high.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is medium to high.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is medium to high.

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This is due to the relatively small proportion of hard substate which may remain post-decommissioning, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore measures have been adopted as part of the Transmission Assets to minimise the effects from the introduction or spread of INNS.	The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This is due to the relatively small proportion of hard substate which may remain post-decommissioning, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore measures have been adopted as part of the Transmission Assets to minimise the effects from the introduction or spread of INNS.	The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This is due to the relatively small proportion of hard substate which may remain post-decommissioning, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore measures have been adopted as part of the Transmission Assets to minimise the effects from the introduction or spread of INNS.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

Table 2.36: Cumulative impact of increased risk of introduction and spread of INNS (Scenario 4a-4c)

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
Construction and Operation and Maintenance Phase			
Sensitivity of receptor	**Subtidal habitat IEFs** (as discussed in **section 2.11.7**). The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The brittlestar beds IEF is deemed to be of medium vulnerability, low recoverability, and national importance. The sensitivity of the receptor is **medium**. The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **medium**. The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. **Fylde MCZ IEFs** The subtidal sand IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high**. The subtidal mud IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high**.		
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 (Transmission Assets Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets) together with the following Tier 1 projects: • Awel y Môr Offshore Wind Farm; • Mona Offshore Wind Project; • Isle of Man Crogga Licence; and	The cumulative effects assessment for Scenario 4b considers Scenario 4a together with the following Tier 2 projects: • Mooir Vannin Offshore Windfarm; and • ENI Hynet CCS. The amount of artificial infrastructure which may be installed as a result of the Mooir Vannin Offshore Windfarm has not yet been quantified, however it is likely to result from wind turbine foundations and cable	The cumulative effects assessment for Scenario 4c considers Scenario 4b together with the following Tier 3 projects: • MaresConnect; • Isle of Man – UK Interconnector 2; and • Mooir Vannin – UK Transmission Assets. These Tier 3 projects are all cable projects. There is currently very little information on the impact that all of these cables will have on benthic ecology receptors however it is

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	• Isle of Man to UK Interconnector Cable maintenance licences (MLA/2016/00211). These projects may result in up to 6.15 km^2 of introduced artificial structures, and up to 44,065 vessel round trips during these phases. The tier 1 project, Awel y Môr Offshore Wind Farm, will introduce up to 1.07 km^2 of new hard substrate to the seabed which, together with the Transmission Assets, will result in up to 1.65 km^2 of artificial hard substrate. The construction of Awel y Môr Offshore Wind Farm is likely to result in up to 3,961 round trips, the operation and maintenance phase is likely to result in 1,232 vessel round trips and the number of round trips for decommissioning has not been defined however is likely to be similar to the 3,961 round trips anticipated during construction (RWE, 2022). The Awel y Môr Offshore Wind Farm will have plans and measures in place to reduce the spread of INNS such as those proposed for the Transmission Assets. For example, Awel y Môr will ensure a biosecurity plan is implemented to ensure relevant best practice guidelines are followed (RWE, 2022). It is expected that these measures will also be in effect for the other offshore wind farms and infrastructure projects in the area, resulting in a low overall increase in the risk of introduction of INNS.	and scour protection (Mooir Vannin Offshore Windfarm Ltd, 2023). A scoping report for the ENI Hynet CCS pipeline states that the introduction of new habitat, such as artificial structures used for pipeline protection, in the offshore marine environment may potentially affect the established community environment by providing new habitat and ecosystem function (Liverpool Bay CCS Ltd, 2022). The scoping report does not however provide estimates of artificial substrate installation with which to make any quantitative assessment. It is likely that all tier 2 projects will implement measures to reduce the potential for the introduction and spread of INNS based on national and international guidance. **Subtidal habitats IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** There are no tier 2 projects which spatially overlap with the Fylde MCZ, therefore no tier 2 assessment of the impact on the Fylde MCZ is required.	likely that artificial structures will be introduced in relation to the cables which may be similar to what is described for the Transmission Assets and Scenario 4b. A planning application is predicted to be submitted for the MaresConnect interconnector cable in 2024 which will identify and assess these impacts (MaresConnect, 2022). Cable protection associated with these cables, is likely to result in the facilitation of the introduction and spread of INNS (e.g. introduction of new hard substrate through cable protection and vessel movements which are likely to be greatest during the construction phase) and likely to be similar to what is expected for the cables of the Transmission Assets. Mooir Vannin – UK Transmission Assets may also include a booster station which would lead to a further increase in the area of artificial structures available for colonisation (Mooir Vannin Offshore Wind Farm Ltd., 2024). With respect to the Fylde MCZ, the Tier 3 projects with the potential to overlap with the Fylde MCZ are the Isle of Man interconnector cable 2 and Mooir Vannin – UK Transmission Assets. Whilst there is currently very information on the impact that these projects will have on the MCZ, some cable protection may be required, although this is likely to be minimal and similar to that required for the artificial structures will be introduced in relation to the cables which may be similar to what is

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	For the Mona Offshore Wind Farm, the predicted cumulative habitat creation would equate to up to 2.19 km^2, with up to 2,215 vessel round trips during the construction phase and up to 29,715 vessel return trips (up to 849 per year) during the operation and maintenance phase (Mona Offshore Wind Ltd, 2023). This tier also includes the Crogga oil and gas exploration licence to drill an appraisal well. No quantification regarding the impact of this activity has been published however based on the nature of the work it is likely that activities such as the installation of a well head and any discarded drill cuttings may result in long term habitat loss (Isle of Man Government, 2021). The extent of hard substrate available for colonisation by INNS is also likely to decline throughout the operation and maintenance phase as some of the projects enter their decommissioning phases. The cumulative introduction of artificial structures associated with the Transmission Assets together with the only other Tier 1 project to overlap with the Fylde MCZ (i.e. the Isle of Man interconnector cable) is estimated at up to 0.036 km^2 within the Fylde MCZ (0.03 km^2 from the Transmission Assets and 0.006 km^2 from the Isle of Man Interconnector), equating to 0.01% of the total area of the MCZ. There may also be some vessel activity associated with the maintenance of the Isle of Man interconnector cable, but this is		described for the existing Isle of Man interconnector cable 1. **Subtidal habitats IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	likely to be less than for the Transmission Assets. Cable protection, the deposition of rock or concrete mattresses, may potentially need to be installed for the Isle of Man - UK Interconnector 1 as part of maintenance activities for this project including within the Fylde MCZ. The MDS assumes a maximum of 2 km of cable would be covered either with 333 mattresses along a narrow corridor (3 m wide) covering a total area of seabed 1,000 m^2 or 12,400 tons of rock would be deposited along a corridor approximately 5 m wide (Manx Utilities Ltd, 2017). If cable protection is required within the Fylde MCZ The MDS is for a 1.2 km section of the cable which could result in up to 0.00624 km^2 of introduced artificial structures (Manx Utilities Ltd, 2017). This maintenance work will also have associated vessel movement which could pass through the Fylde MCZ. **Subtidal habitats IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the		

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	receptor directly. The magnitude is therefore, considered to be **low**.		
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of most subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This is due to the relatively small proportion of hard substate which may be introduced into the Transmission Assets during the construction phase, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore measures have been adopted as part of the Transmission Assets to minimise the effects from the introduction or spread of INNS. Overall, for the subtidal muddy sands and brittlestar beds IEFs, the magnitude of the cumulative impact is low and the sensitivity is medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the Fylde MCZ IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion was reached due to the relatively small proportion of hard	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This is due to the relatively small proportion of hard substate which may be introduced into the Transmission Assets during the construction phase, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore measures have been adopted as part of the Transmission Assets to minimise the effects from the introduction or spread of INNS. Overall, for the subtidal muddy sands and brittlestar beds IEFs, the magnitude of the cumulative impact is low and the sensitivity is medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This is due to the relatively small proportion of hard substate which may be introduced into the Transmission Assets during the construction phase, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore measures have been adopted as part of the Transmission Assets to minimise the effects from the introduction or spread of INNS. Overall, for the subtidal muddy sands and brittlestar beds IEFs, the magnitude of the cumulative impact is low and the sensitivity is medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the Fylde MCZ IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion was reached due to the relatively small proportion of hard

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	substate which may be introduced into the Fylde MCZ, and the small uplift in vessel traffic which could facilitate the introduction of INNS.		substate which may be introduced into the Fylde MCZ, and the small uplift in vessel traffic which could facilitate the introduction of INNS.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		
Decommissioning Phase			
Sensitivity of receptor	The sensitivity of all receptors will be the same as in the construction and operation and maintenance phase, and as listed in **section 2.11.7**.		
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 (Transmission Assets, Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets) together with the following Tier 1 projects: • Mona Offshore Wind Project. The Mona Offshore Wind Project will also be in its decommissioning phase which may result in 2.14 km^2 of infrastructure being left *in situ* such as scour protection and cable protection Mona Offshore Wind Ltd, 2024). The MDS for the decommissioning phase of the Mona Offshore Wind Project is for up to 2,215 vessel return trips over up to four years. With the total of 264 return trips associated with the decommissioning of the	The cumulative effects assessment for Scenario 4b considers Scenario 4a together with the following Tier 2 projects: • Mooir Vannin Offshore Windfarm– Isle of Man wind farm lease area. The scoping report for Mooir Vannin Offshore Windfarm does not specify the impacts which will be assessed in association with the project. It does however provide some of the parameters of the project including that up to 100 turbines may be installed as well as up to five OSPs and 490 km of inter-array cables, 100 km of interconnector cables, 90 km of offshore electrical connection cables and 125 km of export cables may also be installed which will result in artificial structures which would be colonised by INNS (Ørsted, 2023). The number of vessel return trips is not currently known.	The cumulative effects assessment for Scenario 4c considers Scenario 4b together with the following Tier 3 projects: • Mooir Vannin – UK Transmission Assets. There is currently very little information on the impact that this cable will have on benthic ecology receptors however it is likely that artificial structures will be introduced in relation to the cables which may be similar to what is described for the Transmission Assets and Scenario 4b. The Mooir Vannin – UK Transmission Assets may also overlap with the Fylde MCZ. Cable protection associated with these cables, is likely to result in the facilitation of the introduction and spread of INNS (e.g. introduction of new hard substrate through cable protection and vessel movements which are likely to be greatest during the

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	Transmission Assets, this is a total of 2,497 return trips over this phase. The Transmission Assets, Morgan Offshore Wind Project: Generation Assets, Morecambe Offshore Windfarm: Generation Assets and Tier 1 projects may result in up to 3.96 km^2 of long term habitat creation. **Subtidal habitat IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	**Subtidal habitats IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	construction phase) and likely to be similar to what is expected for the cables of the Transmission Assets. Mooir Vannin – UK Transmission Assets may also include a booster station which would lead to a further increase in the area of artificial structures available for colonisation (Mooir Vannin Offshore Wind Farm Ltd., 2024). There is the potential for both the Isle of Man – UK Interconnector 2 and the Mooir Vannin – UK Transmission Assets to overlap with the Fylde MCZ and result in an increased risk of introduction and spread of INNS. **Subtidal habitats IEFs** The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.
Significance of effect	**Subtidal habitat IEFs** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sandy sediments characterised by relatively	**Subtidal habitat IEFs** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sandy sediments characterised by relatively	**Subtidal habitat IEFs** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sandy sediments characterised by relatively

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	diverse infaunal and epifaunal benthic communities IEF and the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is high and the magnitude of the impact is low. The effect will, therefore, be of **minor** adverse significance, which is not significant. This is due to the relatively small proportion of hard substate which may remain post-decommissioning, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore measures have been adopted as part of the Transmission Assets to minimise the effects from the introduction or spread of INNS. Overall, for the subtidal muddy sands with relatively species poor benthic communities IEF and the brittlestar beds IEF the sensitivity of the receptor is medium, and the magnitude of the impact is low. The effect will, therefore, be of **minor** adverse significance, which is not significant.	diverse infaunal and epifaunal benthic communities IEF and the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is high and the magnitude of the impact is low. The effect will, therefore, be of **minor** adverse significance, which is not significant. This is due to the relatively small proportion of hard substate which may remain post-decommissioning, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore measures have been adopted as part of the Transmission Assets to minimise the effects from the introduction or spread of INNS. Overall, for the subtidal muddy sands with relatively species poor benthic communities IEF and the brittlestar beds IEF the sensitivity of the receptor is medium, and the magnitude of the impact is low. The effect will, therefore, be of **minor** adverse significance, which is not significant.	diverse infaunal and epifaunal benthic communities IEF and the seapens and burrowing megafauna communities IEF, the sensitivity of the receptor is high and the magnitude of the impact is low. The effect will, therefore, be of **minor** adverse significance, which is not significant. This is due to the relatively small proportion of hard substate which may remain post-decommissioning, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore measures have been adopted as part of the Transmission Assets to minimise the effects from the introduction or spread of INNS. Overall, for the subtidal muddy sands with relatively species poor benthic communities IEF and the brittlestar beds IEF the sensitivity of the receptor is medium, and the magnitude of the impact is low. The effect will, therefore, be of **minor** adverse significance, which is not significant. **Fylde MCZ IEF** Overall, the magnitude of the cumulative impact is low and the sensitivity of the Fylde MCZ IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion was reached due to the relatively small proportion of hard substate which may be introduced into the Fylde MCZ, and the small uplift in vessel

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
			traffic which could facilitate the introduction of INNS.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

2.13.7 Removal of hard substrates

2.13.7.1 Cumulative removal of hard substrate may result from the removal of infrastructure such as foundations, cable protection and scour protection, wind turbines and OSPs. The cumulative impact of the Transmission Assets and the Morecambe Offshore Windfarm and the Morgan Offshore Wind Project have been assessed for scenarios 1-3 in **Table 2.37** and for scenarios 4a-4c in **Table 2.38**.

Table 2.37: Cumulative impact from the removal of hard substrates (Scenarios 1-3)

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
Decommissioning Phase			
Sensitivity of receptor	As discussed in **section 2.11.8**, the subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. **Subtidal habitat IEFs** The brittlestar beds IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Transmission Assets; and • The Morecambe Offshore Windfarm: Generation Assets. The cumulative removal of hard substrate between these two projects may be up to 1.09 km^2. These two projects include all of the hard substrate removal described in **Table 2.12** associated with the Transmission Assets (0.58 km^2) together with up to 0.51 km^2 associated with the Morecambe Offshore Windfarm.	The cumulative effects assessment for Scenario 2 considers the following: • The Transmission Assets; and • The Morgan Offshore Wind Project: Generation Assets. The cumulative removal of hard substrate between these two projects may be up to 2.37 km^2. These two projects include all of the hard substrate removal described in **Table 2.12** associated with the Transmission Assets (0.58 km^2) together with up to 1.79 km^2 of potential habitat	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets; • The Morecambe Offshore Windfarm: Generation Assets; and • The Morgan Offshore Wind Project: Generation Assets. The cumulative removal of hard substrate between these three projects may be up to 2.88 km^2. These projects do not represent a significant increase in the area of hard substrates removed compared to each scenario separately.

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	Subtidal habitat IEFs The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	removal associated with the Morgan Offshore Wind Project: Generation Assets. **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low.**	**Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion is based on the ability of the sedimentary habitats to recover following decommissioning and the small scale of the change in relation to the wider study area.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion is based on the ability of the sedimentary habitats to recover following decommissioning and the small scale of the change in relation to the wider study area.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion is based on the ability of the sedimentary habitats to recover following decommissioning and the small scale of the change in relation to the wider study area.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

Table 2.38: Cumulative impact of the removal of hard substrates (Scenarios 4a-4c)

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
Decommissioning Phase			
Sensitivity of receptor	**Subtidal habitat IEFs** The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The brittlestar beds IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**. The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is **high**.		
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 (Transmission Assets, Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets) together with the following Tier 1 project: • Mona Offshore Wind Project These projects may result in the removal of up to 5.5701 km^2 of hard substrates and artificial structures. This includes the Mona Offshore Wind Project, which will result in the removal of up to 2.14 km^2 of hard substrates from wind turbine and OSP foundations, scour	The cumulative effects assessment for Scenario 4b considers Scenario 4a together with the following Tier 2 project: • Mooir Vannin – Isle of Man wind farm lease area. This project may result in the removal of up to 5.57 km^2 of hard substrates. The details of the Mooir Vannin Isle of Man wind farm lease area are not currently available, but this project is unlikely to represent a significant decrease in the area of hard substrates within the CEA study area. **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is	No tier 3 projects are predicted to overlap with the decommissioning phase of the Transmission Assets, and these are therefore not considered further in this section.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	protection and cable protection (Mona Offshore Project Ltd, 2024). **Subtidal habitat IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	
Significance of effect	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion is based on the ability of the sedimentary habitats to recover following decommissioning and the small scale of the change in relation to the wider study area.	**Subtidal habitat IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of all the subtidal habitat IEFs is high. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This conclusion is based on the ability of the sedimentary habitats to recover following decommissioning and the small scale of the change in relation to the wider study area.	No tier 3 projects are predicted to overlap with the decommissioning phase of the Transmission Assets, and these are therefore not considered further in this section.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

2.13.8 Changes in physical processes

2.13.8.1 The presence of infrastructure may lead to changes to the tidal and wave regimes, as well as the sediment transport and sediment transport pathways, principally during the operation and maintenance phase and the decommissioning phase of the Transmission Assets. These potential cumulative impacts have been assessed for the Transmission Assets, Morecambe Offshore Windfarm, and Morgan Offshore Wind Project cumulatively in scenarios 1-3 in **Table 2.39** and cumulatively with other projects in scenarios 4a-4c in **Table 2.40**.

Table 2.39: Cumulative changes in physical processes (Scenario 1-3)

<table>
<tr><th></th><th>Scenario 1:
Transmission Assets + Morecambe Offshore Windfarm: Generation Assets</th><th>Scenario 2:
Transmission Assets + Morgan Offshore Wind Project: Generation Assets</th><th>Scenario 3:
Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets</th></tr>
<tr><td colspan="4">Operation and Maintenance Phase</td></tr>
<tr><td>Sensitivity of receptor</td><td colspan="3">Subtidal habitat IEFs (as discussed in section 2.11.9)
The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is negligible.
The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. Th sensitivity of the receptor is negligible.
The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is negligible.
The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore considered to be high (reduced to medium in absence of seapens).
The brittlestar beds IEF is deemed to be of low vulnerability, high recoverability, and national value. The sensitivity of the receptor is negligible.
The low resemblance stony reef IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is negligible.
Shell Flat and Lune Deep SAC IEFs
The sandbanks which are slightly covered by sea water IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be negligible.
The reef IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be negligible.
Fylde MCZ IEFs
The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be negligible.
The subtidal mud IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be negligible.
West of Walney MCZ IEFs</td></tr>
</table>

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. The subtidal mud IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. The seapens and burrowing megafauna IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (reducing to **medium** due to the absence of seapens). **West of Copeland MCZ IEFs** The subtidal coarse sediment IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. The subtidal mixed sediment IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. **Intertidal habitat IEFs** The species poor/barren sands IEF is deemed to be of low vulnerability, recoverability and national value. The sensitivity of the receptor is **negligible**. The polychaete/bivalve-dominated muddy sand shores IEF is deemed to be of low to negligible vulnerability and medium recoverability and national value. The sensitivity of the receptor is considered to be **medium**.		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: The Transmission Assets; and The Morecambe Offshore Windfarm: Generation Assets. The presence of Transmission Assets infrastructure may lead to changes in physical processes and seabed morphology	The cumulative effects assessment for Scenario 2 considers the following: The Transmission Assets; and The Morgan Offshore Wind Project: Generation Assets. The presence of Transmission Assets infrastructure may lead to changes in wave regime during the operation and maintenance phase. The magnitude of changes in the wave	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets; • The Morecambe Offshore Windfarm: Generation Assets; and • The Morgan Offshore Wind Project: Generation Assets.

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	during the operation and maintenance phase of the Transmission Assets. In the operation and maintenance phase the Transmission Assets may cause localised changes in wave climate to be experienced within the Fylde MCZ and Ribble Estuary if cable protection is installed in these areas. The precise magnitude of these changes will be dependent on location and detailed design post-PEIR would minimise these impacts in shallow water; with no material placed on the bed in the inter-tidal zone. The detailed design and commitments to avoid, reduce and mitigate impacts would minimise these impacts in shallow water; with no material placed on the bed in the inter-tidal zone. Given the impact is limited to within 1 km and 500 m for wave climate and tidal currents respectively, it is not expected to affect adjacent shorelines such as Blackpool Beach which is located > 3 km from the landfall location and Lytham St Annes beach and promenade located to the south of the landfall. Any shoreline that may be affected would be highly recoverable due to the minor change in physical processes. As a result of the Transmission Assets, the Fylde MCZ may experience changes in tidal regime if cable protection is placed within these areas these impacts may extend up to circa 500 m from the infrastructure in these shallow areas. Furthermore the provision of	and tidal regimes have been assessed as low adverse for the Transmission Assets alone. Localised changes in wave climate may potentially be experienced within the Fylde MCZ and Ribble Estuary designated areas if Transmission Assets cable protection is installed within this area. The detailed design and commitments to avoid, reduce and mitigate impacts would minimise these impacts in shallow water; with no material placed on the bed in the inter-tidal zone. Given the impact is limited to within 1 km and 500 m for wave climate and tidal currents respectively, it is not expected to affect adjacent shorelines such as Blackpool Beach which is located > 3 km from the landfall location and Lytham St Annes beach and promenade located to the south of the landfall. Fylde MCZ tidal regimes may be affected if cable protection is placed within this area and these impacts may extend up to circa 500 m from the infrastructure in these shallow areas. Provision of cable protection in nearshore regions was seen to have very localised impacts in the immediate vicinity and due to changes in tidal flow, i.e. <1 km. The precise magnitude or these changes will be dependent on location and detailed design prior to ES submission. The Morgan Offshore Wind Project: Generation Assets MDS comprises of 68 turbines that will be in operation during the	The magnitude of the cumulative effect to physical processes and seabed morphology from the Transmission Assets and both sets of Generation Assets will be a combination of scenario 1 and 2 in a spatial sense. However, in terms of impacts due to overlapping changes in physical processes and morphology the magnitude of impact will be no greater than the scenario 1 or 2. This being due to the fact the two Generation Assets are separated by a distance of 16.76 km and owing to the principal orientation of the tidal currents and wave **Subtidal habitat IEFs, Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Intertidal IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**. **Shell Flat and Lune Deep SAC IEFs, West of Walney MCZ IEFs, West of Copeland MCZ IEFs**

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	cable protection in nearshore regions was seen to have very localised impacts in the immediate vicinity and due to changes in tidal flow, i.e. < 1 km. The magnitude of this impact will depend on the site conditions and detailed design post-PEIR would minimise these impacts in nearshore regions where transport patterns are parallel to the coastline. The Morecambe Offshore Windfarm: Generation Assets MDS comprises of 35 turbines 65 m in diameter with conical gravity base suction foundations, each with scour protection extending 15 m from foundations. Changes are expected in close proximity to these structures with said changes decreasing rapidly with distance from the infrastructure, and therefore will not impact on adjacent shorelines. There is partial overlap with the Fylde MCZ and Annex I sandbanks but the impact to physical processes will be indistinguishable from natural variability. Thus, there are no cumulative impacts with the Transmission Assets. **Subtidal habitat IEFs, Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the	operation and maintenance phase of the Transmission Assets. Changes are expected in close proximity to these structures with said changes decreasing rapidly with distance from the infrastructure, and therefore will not impact on adjacent shorelines. Under certain storm conditions changes in physical processes namely wave climate may extend to the edge of West of Walney MCZ and the West of Copeland MCZ however even under 1 in 20 storm conditions this represents less than 0.1% of the wave height and would be indistinguishable from natural variations. The Morgan Offshore Wind Project: Generation Assets MDS also contains an OSP with rectangular gravity base foundation which may affect waves and tides up to 200 m by c. 2 – 4%, at which point changes would rapidly decline. Under certain circumstances, with more extreme storms approaching from the south west, changes in residual currents may extend to west edge of the West of Walney MCZ and the south tip of the West of Copeland MCZ. However these values amount to changes of less than ±1% of the preconstruction values for a 1 in 20 year storm from 270º concentrated at the site of the infrastructure and would be indistinguishable from natural variations. The Transmission Assets and Morgan Offshore Wind Project: Generation Assets are close proximity to each other therefore whilst	Changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect these MCZs. The magnitude is therefore **no change**, and no effect will arise on the West of Copeland MCZ.

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	receptor directly. The magnitude is therefore, considered to be **low**. **Intertidal IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**. **Shell Flat and Lune Deep SAC IEFs, West of Walney MCZ IEFs, West of Copeland MCZ IEFs** Changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect these MCZs. The magnitude is therefore **no change**, and no effect will arise on the West of Copeland MCZ.	there is some limited potential for cumulative impacts in the immediate vicinity of the infrastructure this does not extend to designated receptors of the shoreline. **Subtidal habitat IEFs, Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Intertidal IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**. **Shell Flat and Lune Deep SAC IEFs, West of Walney MCZ IEFs, West of Copeland MCZ IEFs** Changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect these MCZs. The magnitude is therefore **no change**, and no effect will arise on the West of Copeland MCZ.	
Significance of effect	**Subtidal habitat IEFs**	**Subtidal habitat IEFs**	As this scenario does not represent a significant change in physical processes compared to the scenarios separately, the

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	Overall, for most subtidal IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal muddy sands with relatively species poor benthic communities IEF, subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, low resemblance stony reef IEF and the brittlestar beds IEF) the magnitude of the cumulative impact is low and the sensitivity of most subtidal habitat IEFs is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for. Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is low and the sensitivity is high (reduced to medium in the absence of seapens). The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is no change and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is negligible. The cumulative effect will, therefore, be of	Overall, for most subtidal IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal muddy sands with relatively species poor benthic communities IEF, subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, low resemblance stony reef IEF and the brittlestar beds IEF) the magnitude of the cumulative impact is low and the sensitivity of most subtidal habitat IEFs is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for. Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is low and the sensitivity is high (reduced to medium in the absence of seapens). The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is no change and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is negligible. The cumulative effect will, therefore, be of	significance for each receptor will remain the same as in scenario 2.

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	negligible adverse significance, which is not significant in EIA terms. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for. **West of Walney MCZ IEFs** Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is no change and the sensitivity is high (reduced to medium in the absence of seapens). There will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. Overall, for the subtidal sand IEF and the subtidal mud IEF, the magnitude of the cumulative impact is no change and the sensitivity is negligible. There will, therefore,	**negligible** adverse significance, which is not significant in EIA terms **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. **West of Walney MCZ IEFs** Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is no change and the sensitivity is high (reduced to medium in the absence of seapens). There will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. Overall, for the subtidal sand IEF and the subtidal mud IEF, the magnitude of the cumulative impact is no change and the sensitivity is negligible. There will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. **West of Copeland MCZ IEFs** Overall for the subtidal sand IEF, the subtidal mixed sediment IEF and the subtidal coarse sediment IEF of the West of Copeland MCZ, the magnitude of the impact is no change and the sensitivity of the receptors is negligible.	

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	**Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets**	**Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets**
	be no effect on the IEFs of the West of Walney MCZ. **West of Copeland MCZ IEFs** Overall for the subtidal sand IEF, the subtidal mixed sediment IEF and the subtidal coarse sediment IEF of the West of Copeland MCZ, the magnitude of the impact is no change and the sensitivity of the receptors is negligible. There will, therefore, be **no effect** on the IEFs of the West of Copeland MCZ **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the species poor/barren sands IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, for the polychaete/bivalve-dominated muddy sand shores IEF, the magnitude of the impact is negligible and the sensitivity of the receptor is medium. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to	There will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the species poor/barren sands IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, for the polychaete/bivalve-dominated muddy sand shores IEF, the magnitude of the impact is negligible and the sensitivity of the receptor is medium. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	result in a change in conditions beyond the natural variation that this IEF is adapted for.		
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		
Decommissioning Phase			
Sensitivity of receptor	**Subtidal IEFs** The subtidal muddy sands with relatively species poor benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**. The subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**. The low resemblance stony reef IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is **negligible**. The brittlestar beds IEF is deemed to be of low vulnerability, high recoverability, and national value. The sensitivity of the receptor is **negligible**. The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore considered to be high (reduced to **medium** in absence of seapens). **Fylde MCZ** The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. The subtidal mud IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. **Shell Flat and Lune Deep SAC** The sandbanks which are slightly covered by sea water IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**.		

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	The reef IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. **West of Walney MCZ** The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore considered to be high (reduced to **medium** in absence of seapens). The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. The subtidal mud IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. **West of Copeland MCZ** The subtidal coarse sediment IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. The subtidal mixed sediment IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. The subtidal sand IEF is deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **negligible**. **Intertidal habitat IEFs** The species poor/barren sands IEF is deemed to be of low vulnerability, recoverability and national value. The sensitivity of the receptor is **negligible**. The polychaete/bivalve-dominated muddy sand shores IEF is deemed to be of low to negligible vulnerability and medium recoverability and national value. The sensitivity of the receptor is considered to be **medium**. The *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is deemed to be of low vulnerability, recoverability and national value. The sensitivity of the receptor is **negligible**		
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: The Transmission Assets; and	The cumulative effects assessment for Scenario 2 considers the following: • The Transmission Assets; and	The cumulative effects assessment for Scenario 3 considers the following: • The Transmission Assets;

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	The Morecambe Offshore Windfarm: Generation Assets. The decommissioning phase of the Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets coincide. Following decommissioning, changes to physical processes would be of the same magnitude as the operation and maintenance phase. **Subtidal habitat IEFs, Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Intertidal IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**. **Shell Flat and Lune Deep SAC IEFs, West of Walney MCZ IEFs, West of Copeland MCZ IEFs** Changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect these MCZs. The magnitude is therefore **no change**, and no	• The Morgan Offshore Wind Project: Generation Assets. The decommissioning phase of the Transmission Assets and the Morgan Offshore Wind Project: Generation Assets coincide. Following decommissioning, changes to physical processes would be of the same magnitude as the operation and maintenance phase, **Subtidal habitat IEFs, Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Intertidal IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**. **Shell Flat and Lune Deep SAC IEFs, West of Walney MCZ IEFs, West of Copeland MCZ IEFs** Changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect these MCZs. The	• The Morecambe Offshore Windfarm: Generation Assets; and • The Morgan Offshore Wind Project: Generation Assets. The magnitude of the cumulative effect to physical processes and seabed morphology from the Transmission Assets and both sets of Generation Assets will be a combination of scenario 1 and 2 in a spatial sense. However, in terms of impacts due to overlapping changes in physical processes and morphology the magnitude of impact will be no greater than the scenario 1 or 2. This being due to the fact the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets are separated by a distance of 16.76 km and owing to the principal orientation of the tidal currents and wave climate, no increased cumulative effect between the two projects are predicted to occur. **Subtidal habitat IEFs, Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Intertidal IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration,

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	effect will arise on the West of Copeland MCZ.	magnitude is therefore **no change**, and no effect will arise on the West of Copeland MCZ.	continuous and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**. **Shell Flat and Lune Deep SAC IEFs, West of Walney MCZ IEFs, West of Copeland MCZ IEFs** Changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect these MCZs. The magnitude is therefore **no change**, and no effect will arise on the West of Copeland MCZ.
Significance of effect	**Subtidal habitat IEFs** Overall, for most subtidal IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal muddy sands with relatively species poor benthic communities IEF, subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, low resemblance stony reef IEF and the brittlestar beds IEF) the magnitude of the cumulative impact is low and the sensitivity of most subtidal habitat IEFs is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in	**Subtidal habitat IEFs** Overall, for most subtidal IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal muddy sands with relatively species poor benthic communities IEF, subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, low resemblance stony reef IEF and the brittlestar beds IEF) the magnitude of the cumulative impact is low and the sensitivity of most subtidal habitat IEFs is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the	**Subtidal habitat IEFs** Overall, for most subtidal IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal muddy sands with relatively species poor benthic communities IEF, subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, low resemblance stony reef IEF and the brittlestar beds IEF) the magnitude of the cumulative impact is low and the sensitivity of most subtidal habitat IEFs is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	conditions beyond the natural variation that these IEFs are adapted for. Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is low and the sensitivity is high (reduced to medium in the absence of seapens). The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is no change and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to	natural variation that these IEFs are adapted for. Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is low and the sensitivity is high (reduced to medium in the absence of seapens). The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is no change and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. **West of Walney MCZ IEFs** Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is negligible and the	natural variation that these IEFs are adapted for. Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is low and the sensitivity is high (reduced to medium in the absence of seapens). The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is no change and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	result in a change in conditions beyond the natural variation that these IEFs are adapted for. **West of Walney MCZ IEFs** Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is no change and the sensitivity is high (reduced to medium in the absence of seapens). There will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. Overall, for the subtidal sand IEF and the subtidal mud IEF, the magnitude of the cumulative impact is no change and the sensitivity is negligible. There will, therefore, be no effect on the IEFs of the West of Walney MCZ. **West of Copeland MCZ IEFs** Overall, for the subtidal sand IEF, the subtidal mixed sediment IEF and the subtidal coarse sediment IEF of the West of Copeland MCZ, the magnitude of the impact is no change and the sensitivity of the receptors is negligible. There will, therefore, be **no effect** on the IEFs of the West of Copeland MCZ **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the species poor/barren sands IEF and the	sensitivity is high (reduced to medium in the absence of seapens). The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. Overall, for the subtidal sand IEF and the subtidal mud IEF, the magnitude of the cumulative impact is negligible and the sensitivity is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **West of Copeland MCZ IEFs** Overall, for the subtidal sand IEF, the subtidal mixed sediment IEF and the subtidal coarse sediment IEF of the West of Copeland MCZ, the magnitude of the impact is negligible and the sensitivity of the receptors is negligible. cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the species poor/barren sands IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for. **West of Walney MCZ IEFs** Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is no change and the sensitivity is high (reduced to medium in the absence of seapens). There will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. Overall, for the subtidal sand IEF and the subtidal mud IEF, the magnitude of the cumulative impact is no change and the sensitivity is negligible. There will, therefore, be no effect on the IEFs of the West of Walney MCZ. **West of Copeland MCZ IEFs** Overall, for the subtidal sand IEF, the subtidal mixed sediment IEF and the subtidal coarse sediment IEF of the West of Copeland MCZ, the magnitude of the impact is no change and the sensitivity of the receptors is negligible. There will, therefore, be **no effect** on the IEFs of the West of Copeland MCZ **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the species poor/barren sands IEF and the

	Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets
	Echinocardium cordatum and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, for the polychaete/bivalve-dominated muddy sand shores IEF, the magnitude of the impact is negligible and the sensitivity of the receptor is medium. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that this IEF is adapted for.	Overall, for the polychaete/bivalve-dominated muddy sand shores IEF, the magnitude of the impact is negligible and the sensitivity of the receptor is medium. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.	*Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, for the polychaete/bivalve-dominated muddy sand shores IEF, the magnitude of the impact is negligible and the sensitivity of the receptor is medium. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that this IEF is adapted for.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

Table 2.40: Cumulative changes in physical processes (Scenarios 4a-4c)

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
Operation and Maintenance Phase			
Sensitivity of receptor	The sensitivity of all receptors will be the same as in scenario 1-3, and as listed in **section 2.11.9**.		
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 together with the following Tier 1 projects: • Maintenance of Walney Extension 4 Offshore Wind Farm; • Maintenance of Walney Extension 3 Offshore Wind Farm; • Maintenance of Walney 2 Offshore Wind Farm; • Maintenance of Walney 1 Offshore Wind Farm; • Maintenance of Walney export and inter array cables; • Construction of the Mona Offshore Wind Project; • RNLI maintenance activities including – Maintenance/repair of Isle of Man to UK interconnector and replacement of concrete mattresses used for cable protection with rock filled filter units; and • Millom West Platform decommissioning phase. During and following the construction phase of the Transmission Assets there will be gradual changes to wave regime. With changes	The cumulative effects assessment for Scenario 4b considers Scenario 4a together with the following Tier 2 projects: • Mooir Vannin Offshore Wind Farm; and • Proposed development of the Eni Hynet – Carbon Capture Project. The presence of Transmission Assets infrastructure may lead to changes in physical processes and seabed morphology during the operation and maintenance phase of the Transmission Assets. The change has been assessed as being localised, potentially within 1 km and 500 m for wave climate and tidal currents respectively and limited in nature. The proposed development of the Mooir Vannin Offshore Wind Farm is located 2.59 km from the Offshore Order Limits, in deeper water and therefore there is no potential for cumulative impacts. Further project data would be required to assess any potential cumulative impact arising from the proposed Mooir Vannin Offshore Wind Farm in the study area. During construction phase there may be overlap with the proposed development of the Eni Hynet – Carbon Capture Project. However, given the distance of separation of the	There is no overlap between the Transmission Assets and Tier 3 developments during the operation and maintenance phase.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	occurring from the baseline environment (no presence of infrastructure) to the operation and maintenance phase (MDS) therefore the cumulative impacts are assessed where Tier 1 projects which may impact the wave climate and coincide with the operation and maintenance phase. The RNLI beach reprofiling at Lytham St. Annes will take place during the construction phase. The nature of the works will have minimal impact on physical processes due to the diminutive scale. The assessment for the Transmission Assets demonstrates that changes in wave climate and tidal currents are limited to a maximum distance of 1 km and 500 m respectively, from the installation of cable protection when this occurs in shallow water. Lytham St. Annes is located 1.4 km from the Transmission Assets therefore there is no pathway for cumulative impacts. The construction and operation and maintenance phases of Transmission Assets also overlap with the decommissioning phase of the Millom West offshore platform. When this platform is removed from the water column there a potential for cumulative effects with infrastructure associated with the Transmission Assets. Given the Millom West offshore platform utilised suction bucket foundations of a similar scale to those suction bucket foundations assessed for the Morgan Offshore Wind Project: Generation Assets, a similar spatial impact and magnitude is expected. This change will take the form of a restoration of natural physical processes. This	development from the Transmission Assets Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets, no cumulative effect is expected to arise. **Subtidal habitat IEFs, Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Intertidal IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**. **Shell Flat and Lune Deep SAC IEFs, West of Walney MCZ IEFs, West of Copeland MCZ IEFs** Changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect these MCZs. The magnitude is therefore **no change**, and no effect will arise on the West of Copeland MCZ.	

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	effect of the decommissioning of the Millom West platform may have effects to physical processes up to 500 m from the structure's original location. The presence of cable protection associated with the Transmission Assets may alter physical processes in the lee of the structure up to a distance of c. 1 km. Given the projects are situated c. 0.49 km from each other it is possible that a cumulative change in physical processes may arise, however this cumulative change would be minor and highly localised. The assessment for the Transmission Assets demonstrates that changes in wave climate and tidal regime may potentially be experienced 1 km and 500 m respectively from the installation of cable protection when this occurs in shallow water. The magnitude of changes in the sediment transport regime has been assessed as low for the Transmission Assets with very localised impacts in the immediate vicinity. Maintenance activities relating to the operation and maintenance phases of the nearby relevant offshore wind farms may occur during the operation and maintenance phase. These activities may include maintenance or upgrading cable protection, therefore placement of material on the seabed which may affect wave climate, tidal regime and sediment transport. These impacts would be very localised in nature and, given these sites are typically more than 10 km from the Transmission Assets there would be no cumulative impacts.		

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	Subtidal habitat IEFs, Fylde MCZ IEFs The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Intertidal IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**. **Shell Flat and Lune Deep SAC IEFs, West of Walney MCZ IEFs, West of Copeland MCZ IEFs** Changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect these MCZs. The magnitude is therefore **no change**, and no effect will arise on the West of Copeland MCZ.		
Significance of effect	**Subtidal habitat IEFs** Overall, for most subtidal IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal muddy sands with relatively species poor benthic communities IEF, subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF and low resemblance stony reef IEF) the magnitude of the cumulative impact is low and the sensitivity of most subtidal habitat IEFs is negligible. The	**Subtidal habitat IEFs** Overall, for most subtidal IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal muddy sands with relatively species poor benthic communities IEF, subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF and low resemblance stony reef IEF) the magnitude of the cumulative impact is low and the sensitivity of most subtidal habitat IEFs is negligible. The	No Tier 3 projects are predicted to overlap with the operation and maintenance phase of the Transmission Assets, and so Scenario 4c assessment is required.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for. Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is low and the sensitivity is high (reduced to medium in the absence of seapens). The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is no change and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is negligible. The cumulative effect will, therefore, be of **no effect**, which is not significant in EIA terms. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA	cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for. Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is low and the sensitivity is high (reduced to medium in the absence of seapens). The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is no change and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is negligible. The cumulative effect will, therefore, be of **no effect**, which is not significant in EIA terms. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets. **Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA	

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for. **West of Walney MCZ IEFs** Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is no change and the sensitivity is high (reduced to medium in the absence of seapens). The effect will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets. Overall, for the subtidal sand IEF and the subtidal mud IEF, the magnitude of the cumulative impact is no change and the sensitivity is negligible. The effect will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets. **West of Copeland MCZ IEFs** Overall, for the subtidal sand IEF, the subtidal mixed sediment IEF and the subtidal coarse sediment IEF of the West of Copeland MCZ, the magnitude of the impact is no change and the sensitivity of the receptors is negligible. There will, therefore, be **no effect** on the IEFs of the West of Copeland MCZ. This significance has been concluded based on	terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for. **West of Walney MCZ IEFs** Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is no change and the sensitivity is high (reduced to medium in the absence of seapens). The effect will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets. Overall, for the subtidal sand IEF and the subtidal mud IEF, the magnitude of the cumulative impact is no change and the sensitivity is negligible. The effect will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets. **West of Copeland MCZ IEFs** Overall, for the subtidal sand IEF, the subtidal mixed sediment IEF and the subtidal coarse sediment IEF of the West of Copeland MCZ, the magnitude of the impact is no change and the sensitivity of the receptors is negligible. There will, therefore, be **no effect** on the IEFs of the West of Copeland MCZ. This significance has been concluded based on	

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	there being no overlap from the potential physical changes caused by the Transmission Assets. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the species poor/barren sands IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, for the polychaete/bivalve-dominated muddy sand shores IEF, the magnitude of the impact is negligible and the sensitivity of the receptor is medium. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that this IEF is adapted for.	there being no overlap from the potential physical changes caused by the Transmission Assets. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the species poor/barren sands IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, for the polychaete/bivalve-dominated muddy sand shores IEF, the magnitude of the impact is negligible and the sensitivity of the receptor is medium. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that this IEF is adapted for.	
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		
Decommissioning Phase			
Sensitivity of receptor	The sensitivity of all receptors will be the same as in scenario 1-3, and as listed in **section 2.11.9**.		

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
Magnitude of impact	The cumulative effects assessment for Scenario 4a considers Scenario 3 together with the following Tier 1 projects: • Mona Offshore Wind Project residual structures from decommissioning; and • Maintenance/repair of Isle of Man to UK interconnector and replacement of concrete mattresses used for cable protection with rock filled filter units. Localised changes in physical processes and seabed morphology may potentially continue to be experienced within the Fylde MCZ if cable protection is retained within 1 km of these areas. This would be mitigated by the use of low profiled tapered cable protection when it is required in shallow areas. Particularly through CoT114, **Table 2.11**, which outlines all permanent infrastructure located between MLWS and MHWS will be buried to a target depth of 3. Similarly, any additional cable protection provided within or at close proximity to designated area due to the Isle of Man Interconnector may continue to influence physical processes. However due to spacing distance of separation they have no cumulative impact on designated areas or adjacent shorelines. The decommissioning phase of the Transmission Assets and the Mona Offshore Wind Project coincide. Following decommissioning, changes to wave regime would be of lesser magnitude than the operation and maintenance phase, as no structures would remain in the water column to	The cumulative effects assessment for Scenario 4b considers Scenario 4a together with the following Tier 2 projects: • Mooir Vannin Offshore Wind Farm; and • Proposed development of the Eni Hynet – Carbon Capture Project. Following decommissioning, changes to physical processes and seabed morphology would be of lesser magnitude than the operation and maintenance phase, as no structures would remain in the water column to influence physical processes, with only the scour and cable protection retained within the context of the MDS. The proposed development of the Mooir Vannin Offshore Wind Farm located is located 2.59 km from the Transmission Assets, in deeper water and therefore there is no potential for cumulative impacts. As no structures relating to the Morgan Offshore Wind Project: Generation Assets will remain in the water column the cumulative impact seen for the operation and maintenance phases will cease to exist. During decommissioning phase there may be overlap with the proposed development of the Eni Hynet – Carbon Capture Project. However, given the distance of separation of the development from the Transmission, no cumulative effect is expected to arise. As no structures relating to the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation	No Tier 3 projects are predicted to overlap with the decommissioning phase of the Transmission Assets, and so Scenario 4c assessment is required.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	influence physical processes at both sites, with only the scour and cable protection retained within the context of the MDS. The same can be expected for both the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets. **Subtidal habitat IEFs, Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Intertidal IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**. **Shell Flat and Lune Deep SAC IEFs, West of Walney MCZ IEFs, West of Copeland MCZ IEFs** Changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect these MCZs. The magnitude is therefore **no change**, and no effect will arise on the West of Copeland MCZ.	Assets will remain in the water column no cumulative change will arise with the Eni Hynet – Carbon Capture Project. **Subtidal habitat IEFs, Fylde MCZ IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Intertidal IEFs** The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**. **Shell Flat and Lune Deep SAC IEFs, West of Walney MCZ IEFs, West of Copeland MCZ IEFs** Changes to the wave and tidal regime and changes to the sediment transport pathways are not predicted to affect these MCZs. The magnitude is therefore **no change**, and no effect will arise on the West of Copeland MCZ.	
Significance of effect	**Subtidal habitat IEFs** Overall, for most subtidal IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal muddy	**Subtidal habitat IEFs** Overall, for most subtidal IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal muddy	No tier 3 projects are predicted to overlap with the decommissioning phase of the Transmission Assets, and these are therefore not considered further in this section.

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	sands with relatively species poor benthic communities IEF, subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF and low resemblance stony reef IEF) the magnitude of the cumulative impact is low and the sensitivity of most subtidal habitat IEFs is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for. Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is low and the sensitivity is high (reduced to medium in the absence of seapens). The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is no change and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is negligible. The cumulative effect will, therefore, be of **no effect**, which is not significant in EIA terms. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets.	sands with relatively species poor benthic communities IEF, subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF and low resemblance stony reef IEF) the magnitude of the cumulative impact is low and the sensitivity of most subtidal habitat IEFs is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for. Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is low and the sensitivity is high (reduced to medium in the absence of seapens). The cumulative effect will, therefore, be of **minor** significance, which is not significant in EIA terms. **Shell Flat and Lune Deep SAC IEFs** Overall, the magnitude of the cumulative impact is no change and the sensitivity of the sandbanks which are slightly covered by sea water IEF and the reef IEF is negligible. The cumulative effect will, therefore, be of **no effect**, which is not significant in EIA terms. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets.	

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	Fylde MCZ IEFs Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for. **West of Walney MCZ IEFs** Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is no change and the sensitivity is high (reduced to medium in the absence of seapens). The effect will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets. Overall, for the subtidal sand IEF and the subtidal mud IEF, the magnitude of the cumulative impact is no change and the sensitivity is negligible. The effect will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets.	**Fylde MCZ IEFs** Overall, the magnitude of the cumulative impact is low and the sensitivity of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ is negligible. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that these IEFs are adapted for. **West of Walney MCZ IEFs** Overall, for the seapens and burrowing megafauna communities IEF, the magnitude of the cumulative impact is no change and the sensitivity is high (reduced to medium in the absence of seapens). The effect will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets. Overall, for the subtidal sand IEF and the subtidal mud IEF, the magnitude of the cumulative impact is no change and the sensitivity is negligible. The effect will, therefore, be **no effect** on the IEFs of the West of Walney MCZ. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets.	

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
	West of Copeland MCZ IEFs Overall, for the subtidal sand IEF, the subtidal mixed sediment IEF and the subtidal coarse sediment IEF of the West of Copeland MCZ, the magnitude of the impact is no change and the sensitivity of the receptors is negligible. There will, therefore, be **no effect** on the IEFs of the West of Copeland MCZ. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the species poor/barren sands IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, for the polychaete/bivalve-dominated muddy sand shores IEF, the magnitude of the impact is negligible and the sensitivity of the receptor is medium. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that this IEF is adapted for.	**West of Copeland MCZ IEFs** Overall, for the subtidal sand IEF, the subtidal mixed sediment IEF and the subtidal coarse sediment IEF of the West of Copeland MCZ, the magnitude of the impact is no change and the sensitivity of the receptors is negligible. There will, therefore, be **no effect** on the IEFs of the West of Copeland MCZ. This significance has been concluded based on there being no overlap from the potential physical changes caused by the Transmission Assets. **Intertidal habitat IEFs** Overall, the magnitude of the cumulative impact is negligible and the sensitivity of the species poor/barren sands IEF and the *Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand IEF is negligible. The cumulative effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. Overall, for the polychaete/bivalve-dominated muddy sand shores IEF, the magnitude of the impact is negligible and the sensitivity of the receptor is medium. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms. This significance has been assigned due to the minimal change to the physical environment which is unlikely to result in a change in conditions beyond the natural variation that this IEF is adapted for.	

	Scenario 4a Scenario 3 (Transmission Assets and Generation Assets) + Tier 1	Scenario 4b: Scenario 4a + Tier 2	Scenario 4c: Scenario 4b + Tier 3
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures than those committed to in **Table 2.11** are proposed.		

2.14 Transboundary effects

2.14.1.1 A screening of transboundary impacts has been carried out (see Volume 1, Annex 5.4: Transboundary screening of the ES) and has identified that there was no potential for significant transboundary effects with regard to benthic subtidal and intertidal ecology from the Transmission Assets upon the interests of other states.

2.14.1.2 The offshore components of the Transmission Assets and the study area are located within UK and Isle of Man territorial waters, which were considered as part of the baseline assessment. Any impacts on benthic receptors due to construction, operation and maintenance, and decommissioning activities are likely to be confined to within the Offshore Order Limits and a distance of one spring tidal excursion from the offshore elements of the Transmission Assets. Therefore, no transboundary impacts with regards to benthic subtidal and intertidal ecology are anticipated and no significant effects would arise.

2.15 Inter-related effects

2.15.1.1 Inter-relationships are the impacts and associated effects of different aspects of the Transmission Assets on the same receptor. These are as follows:

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the Transmission Assets (construction, operation and maintenance, and decommissioning), to interact to potentially create a more significant effect on a receptor group than if just one phase were assessed in isolation.
- Receptor led effects: Assessment of the scope for all relevant effects across multiple topics to interact, spatially and temporally, to create inter-related effects on a receptor.

2.15.1.2 A description of the likely interactive effects arising from the Transmission Assets on benthic subtidal and intertidal ecology is provided in Volume 4, Chapter 3: Inter-relationships of the ES. There is no change in the significance of effects resulting from the inter-related assessment for benthic subtidal and intertidal ecology.

2.16 Summary of impacts, mitigation measures and monitoring

2.16.1.1 Information on benthic subtidal and intertidal ecology within the study area was collected through a desktop review, benthic subtidal and intertidal site surveys, and consultation with relevant stakeholders.

2.16.1.2 **Table 2.41** presents a summary of the impacts, measures adopted as part of the Transmission Assets and residual effects in respect to benthic subtidal and intertidal ecology. The impacts assessed include temporary habitat loss/disturbance, increased SSC and associated deposition, disturbance/remobilisation of sediment-bound contaminants, long term habitat loss, introduction of artificial structures, increased risk of introduction and spread of INNS, removal of hard substrates, changes in physical processes, impacts to benthic invertebrates due to EMF and heat from subsea electrical cables. Overall, it is concluded that there will be no significant effects arising from the Transmission Assets during the construction, operation and maintenance, or decommissioning phases.

2.16.1.3 **Table 2.42** presents a summary of the potential cumulative impacts, mitigation measures and residual effects. The cumulative impacts assessed include temporary habitat loss/disturbance, increased SSC and associated deposition, long term habitat loss, introduction of artificial structures, increased risk of introduction and spread of INNS, removal of hard substrates and changes in physical processes. Overall, it is concluded that there will be significant cumulative effects (moderate adverse) in the short to medium term from temporary habitat disturbance/loss associated with the Transmission Assets alongside the Morgan Offshore Wind Project: Generation Assets and other tier 2 and tier 3 projects. The significance of the cumulative effects is, however predicted to decrease to minor adverse significance in the long term as the sediments and associated benthic communities will recover over time. Therefore, effects of minor adverse significance are predicted in the long term which is not significant. There will be no significant cumulative effects from the Transmission Assets alongside other projects/plans for any other impact pathway.

2.16.1.4 No potential transboundary impacts have been identified in regard to effects of the Transmission Assets.

Table 2.41: Summary of environmental effects, mitigation and monitoring

Description of impact	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
Temporary habitat loss/disturbance	✓	✓	✓	CoT45 CoT47 CoT49 CoT64 CoT65 CoT108 CoT109 CoT115 CoT116 CoT117	C & D Subtidal habitat IEFs: Low Fylde MCZ IEFs: Low Intertidal habitat IEFs: Negligible O Subtidal habitat IEFs: Low Fylde MCZ IEFs: Low Intertidal habitat IEFs: Low	Subtidal habitat IEFs: Medium Fylde MCZ IEFs: Medium Intertidal habitat IEFs: Medium	C, O & D Subtidal habitat IEFs: Minor adverse Fylde MCZ IEFs: Minor adverse Intertidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Increased SSC and associated deposition	✓	✓	✓	CoT45 CoT47 CoT65 CoT115 CoT116 CoT117	C & D Subtidal habitat IEFs: Low Shell Flat and Lune Deep SAC IEFs: Negligible	Subtidal habitat/ Fylde MCZ/West of Copeland MCZ IEFs: Negligible to Medium Shell Flat and Lune Deep SAC IEFs: Low	C & D Subtidal habitat IEFs: Negligible to minor adverse Shell Flat and Lune Deep SAC IEFs: Negligible adverse	None proposed beyond existing commitments.	Minor/ Negligible adverse	None

Description of impact	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
					Fylde MCZ IEFs: Low West of Walney MCZ IEFs: Negligible West of Copeland MCZ IEFs: Negligible Intertidal IEFs: Negligible O Subtidal habitat IEFs: Negligible Shell Flat and Lune Deep SAC IEFs: Negligible Fylde MCZ IEFs: Negligible West of Walney MCZ IEFs: Negligible West of Copeland MCZ	West of Walney MCZ/Intertidal IEFs: Negligible	Fylde MCZ IEFs: Negligible adverse to Minor adverse West of Walney MCZ IEFs: Negligible adverse West of Copeland MCZ IEFs: Negligible adverse Intertidal IEFs: Negligible adverse O Subtidal habitat IEFs: Negligible adverse Shell Flat and Lune Deep SAC IEFs: Negligible adverse Fylde MCZ IEFs: Negligible adverse West of Walney MCZ IEFs: Negligible adverse			

Description of impact	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
					IEFs: Negligible Intertidal IEFs: Negligible		West of Copeland MCZ IEFs: Negligible adverse Intertidal IEFs: Negligible adverse			
Disturbance/remobilisation of sediment-bound contaminants	✓	✓	✓	CoT65	C, O & D Subtidal habitat IEFs: Negligible Shell Flat and Lune Deep SAC IEFs: Negligible Fylde MCZ IEFs: Negligible West of Walney MCZ IEFs: Negligible West of Copeland MCZ IEFs: Negligible Intertidal IEFs: Negligible	Subtidal habitat IEFs: Low to Medium Shell Flat and Lune Deep SAC IEFs: Low Fylde MCZ IEFs: Low West of Walney MCZ IEFs: Low to Medium West of Copeland MCZ IEFs: Low Intertidal IEFs: Low	C, O & D Subtidal habitat IEFs: Negligible to minor adverse Shell Flat and Lune Deep SAC IEFs: Negligible adverse Fylde MCZ IEFs: Negligible adverse West of Walney MCZ IEFs: Negligible to minor adverse West of Copeland MCZ IEFs: Negligible adverse Intertidal IEFs: Negligible adverse	None proposed beyond existing commitments.	Negligible adverse	None

Description of impact	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
Long term habitat loss	✓	✓	✓	CoT45 CoT47 CoT49 CoT108 CoT109 CoT114	C & O Subtidal habitat IEFs: Low Fylde MCZ IEFs: Low D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High Fylde MCZ IEFs: High	C & O Subtidal habitat IEFs: Minor adverse Fylde MCZ IEFs: Minor adverse D Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Introduction of artificial structures	✓	✓	✓	CoT108 CoT109 CoT114	C, O & D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High	C, O & D Subtidal habitat IEFs: Minor adverse Fylde MCZ IEFs: Minor adverse	None	Minor adverse	None
Increased risk of introduction and spread of INNS	✓	✓	✓	CoT65 CoT108 CoT109	C, O & D Subtidal habitat IEFs: Low Fylde MCZ IEFs: Low	Subtidal habitat IEFs: Medium to High Fylde MCZ IEFs: Medium to High	C, O & D Subtidal habitat IEFs: Minor adverse Fylde MCZ IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Removal of hard substrates	×	×	✓	-	Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High	Subtidal habitat IEFs: Minor adverse	None	Minor adverse	None

Description of impact	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
Changes in physical processes	✗	✓	✓	CoT45 CoT47 CoT49 CoT54 CoT108 CoT109 CoT114	O & D Subtidal habitat IEFs: Low Shell Flat and Lune Deep SAC IEFs: No change Fylde MCZ IEFs: Low West of Walney MCZ IEFs: No change West of Copeland MCZ IEFs: No change Intertidal IEFs: Negligible	Subtidal habitat IEFs: Negligible to Medium Shell Flat and Lune Deep SAC: Negligible Fylde MCZ: Negligible West of Walney: Negligible to Medium West of Copeland MCZ IEFs: Negligible Intertidal IEFs: Negligible to medium	Subtidal habitat IEFs: Negligible to minor adverse Shell Flat and Lune Deep SAC IEFs: No effect Fylde MCZ IEFs: Minor adverse West of Walney MCZ IEFs: No Effect West of Copeland MCZ IEFs: No Effect Intertidal IEFs: Negligible adverse	None	Minor/ Negligible adverse/No effect	None
Impacts to benthic invertebrates due to EMF	✗	✓	✗	CoT47	Subtidal habitat IEFs: Low Fylde MCZ: Low Intertidal IEFs: Low	Subtidal habitat IEFs: Low Fylde MCZ IEFs: Low Intertidal IEFs: Low	Subtidal habitat IEFs: Negligible adverse Fylde MCZ: Negligible adverse Intertidal IEFs: Negligible adverse	None proposed beyond existing commitments.	Negligible adverse	None

Description of impact	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
Heat from subsea electrical cables	×	✓	×	CoT47	Subtidal habitat IEFs: Negligible Fylde MCZ: Negligible	Subtidal habitat IEFs: Negligible to Medium Fylde MCZ: Low	Subtidal habitat IEFs: Negligible adverse Fylde MCZ: Negligible adverse	None proposed beyond existing commitments.	Negligible adverse	None

[a] C=construction, O=operation and maintenance, D=decommissioning. Differences in magnitude, sensitivity and significance are highlighted, otherwise the value given applies in all phases.

Table 2.42: Summary of cumulative environmental effects, mitigation and monitoring

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
Scenario 1: Transmission Assets together with Morecambe Offshore Windfarm: Generation Assets.										
Temporary habitat loss/disturbance	✓	✓	✓	CoT45 CoT47 CoT49 CoT64 CoT65 CoT108 CoT109 CoT115 CoT116 CoT117	<u>C, O & D</u> Subtidal habitat IEFs: Low	Subtidal habitat IEFs: Medium	<u>C, O & D</u> Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Increases in SSC and associated deposition	✓	✓	✓	CoT45 CoT47 CoT65 CoT115 CoT116 CoT117	<u>C</u> Subtidal habitat IEFs: Low Shell Flat and Lune Deep SAC IEFs: Low Fylde MCZ IEFs: Low West of Walney MCZ IEFs: Low West of Copeland MCZ IEFs: Low Intertidal IEFs: Low <u>O & D</u>	Subtidal habitat IEFs: Negligible to Medium Shell Flat and Lune Deep SAC IEFs: Low Fylde MCZ IEFs: Negligible to Low West of Walney MCZ IEFs: Negligible	<u>C</u> Subtidal habitat IEFs: Negligible to Minor adverse Shell Flat and Lune Deep SAC IEFs: Negligible adverse Fylde MCZ IEFs: Negligible adverse to minor adverse West of Walney MCZ IEFs: Negligible adverse	None proposed beyond existing commitments.	Negligible/ Minor adverse	None

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
					Subtidal habitat IEFs: Negligible Shell Flat and Lune Deep SAC IEFs: Negligible Fylde MCZ IEFs: Negligible West of Walney MCZ IEFs: Negligible West of Copeland MCZ IEFs: Negligible Intertidal IEFs: Negligible	West of Copeland MCZ IEFs: Negligible to Low Intertidal IEFs: Negligible	West of Copeland MCZ IEFs: Negligible adverse Intertidal IEFs: Negligible adverse O & D Subtidal habitat IEFs: Negligible to Minor adverse Shell Flat and Lune Deep SAC IEFs: Negligible adverse Fylde MCZ IEFs: Negligible adverse West of Walney MCZ IEFs: Negligible adverse West of Copeland MCZ IEFs: Negligible adverse Intertidal IEFs: Negligible adverse			
Long term habitat loss	✓	✓	✓	CoT45 CoT47 CoT49 CoT108 CoT109	C, O & D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High	C, O & D Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
				CoT114						
Introduction of artificial structures	✓	✓	✓	CoT108 CoT109 CoT114	C, O & D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High	C, O & D Subtidal habitat IEFs: Minor adverse	None	Minor adverse	None
Increased risk of INNS	✓	✓	✓	CoT65 CoT108 CoT109	C, O & D Subtidal habitat IEFs Low	Subtidal habitat IEFs: Medium to High	C, O & D Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Removal of hard substrates	×	×	✓	-	D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High	D Subtidal habitat IEFs: Minor adverse	None	Minor adverse	None
Changes in physical processes	×	✓	✓	CoT45 CoT47 CoT49 CoT54 CoT108 CoT109 CoT114	O & D Subtidal habitat IEFs: Low Shell Flat and Lune Deep SAC IEFs: No change Fylde MCZ IEFs: Low West of Walney MCZ IEFs: No change West of Copeland MCZ IEFs: No change	Subtidal habitat IEFs: Negligible to medium Shell Flat and Lune Deep SAC IEFs: Negligible Fylde MCZ IEFs: Negligible West of Walney MCZ IEFs: Negligible to Medium	O & D Subtidal habitat IEFs: Negligible to Minor adverse Shell Flat and Lune Deep SAC IEFs: Negligible Fylde MCZ IEFs: Minor adverse West of Walney MCZ IEFs: No effect West of Copeland MCZ IEFs: No effect	None	Negligible adverse	None

Description of effect	Phase[a] C	O	D	Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
					Intertidal IEFs: Negligible	West of Copeland MCZ IEFs: Negligible Intertidal IEFs: Negligible to Medium	Intertidal IEFs: Negligible adverse			
Scenario 2: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets, and Scenario 3: Transmission Assets together with both the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets.										
Temporary habitat loss/disturbance	✓	✓	✓	CoT45 CoT47 CoT49 CoT64 CoT65 CoT108 CoT109 CoT115 CoT116 CoT117	C Subtidal habitat IEFs: Medium O & D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: Medium	C Subtidal habitat IEFs: Moderate adverse (short to medium term), reducing to minor adverse (long term) O & D Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	C: Moderate, reducing to minor adverse O, D: Minor adverse	None
Increase in SSC and associated deposition	✓	✓	✓	CoT45 CoT47 CoT65 CoT115 CoT116	C Subtidal habitat IEFs: Low Shell Flat and Lune Deep SAC IEFs: Low	Subtidal habitat IEFs: Negligible to Medium	C Subtidal habitat IEFs: Negligible to Minor adverse	None proposed beyond existing commitments.	Negligible/ Minor adverse	None

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
				CoT117	Fylde MCZ IEFs: Low West of Walney MCZ IEFs: Low West of Copeland MCZ IEFs: Low Intertidal IEFs: Low <u>O & D</u> Subtidal habitat IEFs: Negligible Shell Flat and Lune Deep SAC IEFs: Negligible Fylde MCZ IEFs: Negligible West of Walney MCZ IEFs: Negligible West of Copeland MCZ IEFs: Negligible Intertidal IEFs: Negligible	Shell Flat and Lune Deep SAC IEFs: Low Fylde MCZ IEFs: Low West of Walney MCZ IEFs: Negligible West of Copeland MCZ IEFs: Negligible to Low Intertidal IEFs: Negligible	Shell Flat and Lune Deep SAC IEFs: Negligible Fylde MCZ IEFs: Negligible to Minor adverse West of Walney MCZ IEFs: Negligible adverse West of Copeland MCZ IEFs: Negligible to Minor adverse Intertidal IEFs: Negligible adverse <u>O & D</u> Subtidal habitat IEFs: Negligible to Minor adverse Shell Flat and Lune Deep SAC IEFs: Negligible adverse Fylde MCZ IEFs: Negligible adverse West of Walney MCZ IEFs: Negligible adverse West of Copeland MCZ IEFs: Negligible adverse			

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
							Intertidal IEFs: Negligible adverse			
Long term habitat loss	✓	✓	✓	CoT45 CoT47 CoT49 CoT108 CoT109 CoT114	C, O & D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High	C, O & D Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Introduction of artificial structures	✓	✓	✓	CoT108 CoT109 CoT114	C, O & D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High	C, O & D Subtidal habitat IEFs: Minor adverse	None	Minor adverse	None
Increased risk of INNS	✓	✓	✓	CoT65 CoT108 CoT109	C, O & D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: Medium to High	C, O & D Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Removal of hard substrates	×	×	✓	-	D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High	D Subtidal habitat IEFs: Minor adverse	None	Minor adverse	None
Changes in physical processes	×	✓	✓	CoT45 CoT47 CoT49 CoT54 CoT108	O & D Subtidal habitat IEFs: Low Shell Flat and Lune Deep SAC IEFs: No change	Subtidal habitat IEFs: Negligible Shell Flat and Lune Deep	O & D Subtidal habitat IEFs: Negligible to Minor adverse	None	Negligible adverse	None

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
				CoT109 CoT114	Fylde MCZ IEFs: Low West of Walney MCZ IEFs: No change West of Copeland MCZ IEFs: No change Intertidal IEFs: Negligible	SAC IEFs: Negligible Fylde MCZ IEFs: Negligible West of Walney MCZ IEFs: Negligible to Medium West of Copeland MCZ IEFs: Negligible to Medium Intertidal IEFs: Negligible to Medium	Shell Flat and Lune Deep SAC IEFs: Negligible Fylde MCZ IEFs: Minor adverse West of Walney MCZ IEFs: No effect West of Copeland MCZ IEFs: No effect Intertidal IEFs: Negligible adverse			
Scenario 4a: Scenario 3 (Transmission Assets and Generation Assets) and Tier 1 projects.										
Temporary habitat loss/disturbance	✓	✓	×	CoT45 CoT47 CoT49 CoT64 CoT65 CoT108 CoT109 CoT115 CoT116	<u>C</u> Subtidal habitat IEF: Medium Fylde MCZ: Low <u>O</u> Subtidal habitat IEF: Low Fylde MCZ: Low <u>D</u> Subtidal habitat IEF:	<u>C & O</u> Subtidal habitat IEFs: Medium Fylde MCZ IEFs: Medium <u>D</u> Subtidal habitat IEFs: Medium	<u>C & O</u> Subtidal habitat IEFs: Moderate adverse (short to medium term), reducing to minor adverse (long term) Fylde MCZ IEFs: Minor adverse <u>D</u>	None proposed beyond existing commitments.	Minor adverse	None

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
				CoT117	Low		Subtidal habitat IEFs: Minor adverse			
Increase in suspended sediment concentration and associated deposition	✓	✓	✓	CoT45 CoT47 CoT65 CoT115 CoT116 CoT117	C Subtidal habitat IEFs: Negligible Shell Flat and Lune Deep SAC IEFs: Low Fylde MCZ IEFs: Low West of Walney MCZ IEFs: Negligible West of Copeland MCZ IEFs: Negligible Intertidal IEFs: Negligible O&D Subtidal habitat IEFs: Low Shell Flat and Lune Deep SAC IEFs: Low Fylde MCZ IEFs: Low West of Walney MCZ IEFs: Low	Subtidal habitat IEFs: Negligible to Medium Shell Flat and Lune Deep SAC IEFs: Low Fylde MCZ IEFs: Low West of Walney MCZ IEFs: Negligible West of Copeland MCZ IEFs: Negligible to Low Intertidal IEFs: Negligible to medium	C Subtidal habitat IEFs: Negligible adverse Shell Flat and Lune Deep SAC IEFs: Minor adverse Fylde MCZ IEFs: Negligible to Minor adverse West of Walney MCZ IEFs: Negligible adverse West of Copeland MCZ IEFs: Negligible adverse Intertidal IEFs: Negligible adverse O&D Subtidal habitat IEFs: Negligible to Minor adverse Shell Flat and Lune Deep SAC IEFs: Minor adverse Fylde MCZ IEFs: Minor adverse	None proposed beyond existing commitments.	Negligible/ Minor adverse	None

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
					West of Copeland MCZ IEFs: Low Intertidal IEFs: Negligible		West of Walney MCZ IEFs: Negligible West of Copeland MCZ IEFs: Negligible Intertidal IEFs: Negligible			
Long term habitat loss	✓	✓	✓	CoT45 CoT47 CoT49 CoT108 CoT109 CoT114	C&O Subtidal habitat IEFs: Low Fylde MCZ IEFs: Low D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High Fylde MCZ IEFs: High	C&O Subtidal habitat IEFs: Minor adverse Fylde MCZ IEFs: Minor adverse D Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Introduction of artificial structures	✓	✓	✓	CoT108 CoT109 CoT114	C&O Subtidal habitat IEFs: Low Fylde MCZ IEFs: Low D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High Fylde MCZ IEFs: High	C&O Subtidal habitat IEFs: Minor adverse Fylde MCZ IEFs: Minor adverse D Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
Increased risk of INNS	✓	✓	✓	CoT65 CoT108 CoT109	C&O Subtidal habitat IEFs: Low Fylde MCZ IEFs: Low D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High	C&O Subtidal habitat IEFs: Minor adverse Fylde MCZ IEFs: Minor adverse D Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Removal of hard substrates	×	×	✓	-	Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High	Subtidal habitat IEFs: Minor adverse	None	Minor adverse	None
Changes in physical processes	✓	✓	×	CoT45 CoT47 CoT49 CoT54 CoT108 CoT109 CoT114	Subtidal habitat IEFs: Low Shell Flat and Lune Deep SAC IEFs: No change Fylde MCZ IEFs: Low West of Walney MCZ IEFs: No change West of Copeland MCZ IEFs: No change Intertidal IEFs: Negligible	Subtidal habitat IEFs: Negligible	Subtidal habitat IEFs: Negligible adverse Shell Flat and Lune Deep SAC IEFs: No Effect Fylde MCZ IEFs: Minor adverse West of Walney MCZ IEFs: No Effect West of Copeland MCZ IEFs: No Effect Intertidal IEFs: Negligible adverse	None proposed beyond existing commitments.	Negligible adverse	None

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
Scenario 4b: Scenario 4a with Tier 2 projects										
Temporary habitat loss/disturbance	✓	✓	✓	CoT45 CoT47 CoT49 CoT64 CoT65 CoT108 CoT109 CoT115 CoT116 CoT117	C Subtidal habitat IEFs: Medium O & D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: Medium	C Subtidal habitat IEFs: Moderate adverse (short to medium term), reducing to minor adverse (long term) O & D Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Moderate, reducing to minor adverse	None
Increase in suspended sediment concentration and associated deposition	✓	✓	✓	CoT45 CoT47 CoT65 CoT115 CoT116 CoT117	C Subtidal habitat IEFs: Low Shell Flat and Lune Deep SAC IEFs: Low Fylde MCZ IEFs: Low West of Walney MCZ IEFs: Low West of Copeland MCZ IEFs: Low Intertidal IEFs: Low O	Subtidal habitat IEFs: Negligible to Low Shell Flat and Lune Deep SAC IEFs: Low Fylde MCZ IEFs: Negligible West of Walney MCZ IEFs: Negligible West of Copeland MCZ	C Subtidal habitat IEFs: Negligible to minor adverse Shell Flat and Lune Deep SAC IEFs: Minor adverse Fylde MCZ IEFs: Negligible adverse to Minor adverse West of Walney MCZ IEFs: Negligible adverse West of Copeland MCZ IEFs: Negligible adverse	None proposed beyond existing commitments.	Negligible/ Minor adverse	None

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
					Subtidal habitat IEFs: Negligible Shell Flat and Lune Deep SAC IEFs: Negligible Fylde MCZ IEFs: Negligible West of Walney MCZ IEFs: Negligible West of Copeland MCZ IEFs: Negligible Intertidal IEFs: Negligible D Subtidal habitat IEFs: Low Shell Flat and Lune Deep SAC IEFs: Low Fylde MCZ IEFs: Low West of Walney MCZ IEFs: Low West of Copeland MCZ IEFs: Low Intertidal IEFs: Low	IEFs: Negligible Intertidal IEFs: Negligible	Intertidal IEFs: Negligible adverse O Subtidal habitat IEFs: Negligible to minor adverse Shell Flat and Lune Deep SAC IEFs: Minor adverse Fylde MCZ IEFs: Negligible adverse West of Walney MCZ IEFs: Negligible adverse West of Copeland MCZ IEFs: Negligible adverse Intertidal IEFs: Negligible adverse D Subtidal habitat IEFs: Negligible to minor adverse Shell Flat and Lune Deep SAC IEFs: Minor adverse Fylde MCZ IEFs: Negligible to minor adverse			

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
							West of Walney MCZ IEFs: Negligible adverse West of Copeland MCZ IEFs: Negligible adverse Intertidal IEFs: Negligible adverse			
Long term habitat loss	✓	✓	✓	CoT45 CoT47 CoT49 CoT108 CoT109 CoT114	Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High	Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Introduction of artificial structures	×	✓	✓	CoT108 CoT109 CoT114	Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High	Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Increased risk of INNS	✓	✓	✓	CoT65 CoT108 CoT109	Subtidal habitat IEFs: Low	Subtidal habitat IEFs: Medium to High	Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Removal of hard substrates	×	×	✓	-	Subtidal habitat IEFs: Low	Subtidal habitat IEFs: High	Subtidal habitat IEFs: Minor adverse	None	Minor adverse	None

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
Changes in physical processes	✓	✓	×	CoT45 CoT47 CoT49 CoT54 CoT108 CoT109 CoT114	Subtidal habitat IEFs: Low Shell Flat and Lune Deep SAC IEFs: No change Fylde MCZ IEFs: Low West of Walney MCZ IEFs: No change West of Copeland MCZ IEFs: No change Intertidal IEFs: Low	Subtidal habitat IEFs: Negligible	Subtidal habitat IEFs: Negligible to minor adverse Shell Flat and Lune Deep SAC IEFs: No Effect Fylde MCZ: Minor adverse West of Walney MCZ IEFs: No Effect West of Copeland MCZ IEFs: No Effect Intertidal IEFs: Negligible adverse	None proposed beyond existing commitments.	Negligible adverse	None
Scenario 4c: Scenario 4b and Tier 3 projects										
Temporary habitat loss/disturbance	✓	✓	×	CoT45 CoT47 CoT49 CoT64 CoT65 CoT108 CoT109 CoT115 CoT116 CoT117	C Subtidal habitat IEFs: Medium O Subtidal habitat IEFs: Low Fylde MCZ IEFs: Low D Subtidal habitat IEFs: Low	Subtidal habitat IEFs: Medium Fylde MCZ IEFs: Medium	C Subtidal habitat IEFs: Moderate adverse (short to medium term), reducing to minor adverse (long term) O Subtidal habitat IEFs: Minor adverse	None proposed beyond existing commitments.	Moderate, reducing to minor adverse	None

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
					Fylde MCZ IEFs: Low		Fylde MCZ IEFs: Minor adverse D Subtidal habitat IEFs: Minor adverse Fylde MCZ IEFs: Minor adverse			
Increase in suspended sediment concentration and associated deposition	✓	×	×	CoT45 CoT47 CoT65 CoT115 CoT116 CoT117	Subtidal habitat IEFs, Fylde MCZ IEFs, West of Walney MCZ IEFs, Intertidal habitat IEFs and Shell Flat and Lune Deep SAC IEFs, West of Copeland MCZ IEFs: Low	Subtidal habitat IEFs: Negligible to Low Shell Flat and Lune Deep SAC IEFs: Low Fylde MCZ IEFs: Negligible West of Walney MCZ IEFs: Negligible West of Copeland MCZ IEFs: Negligible Intertidal IEFs: Negligible	C Subtidal habitat IEFs: Negligible to minor adverse Shell Flat and Lune Deep SAC IEFs: Minor adverse Fylde MCZ IEFs: Negligible adverse to Minor adverse West of Walney MCZ IEFs: Negligible adverse West of Copeland MCZ IEFs: Negligible adverse Intertidal IEFs: Negligible adverse Intertidal IEFs: Negligible adverse	None proposed beyond existing commitments.	Minor adverse	None

Description of effect	Phase[a]			Commitment number (Table 2.11)	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
Long term habitat loss	✓	✓	✓	CoT45 CoT47 CoT49 CoT108 CoT109 CoT114	Subtidal habitat IEFs: Low Fylde MCZ IEFs: Low	Subtidal habitat IEFs: High Fylde MCZ IEFs: High	Subtidal habitat IEFs: Minor adverse Fylde MCZ IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Introduction of artificial structures	✗	✓	✓	CoT108 CoT109 CoT114	Subtidal habitat IEFs: Low Fylde MCZ IEFs: Low	Subtidal habitat IEFs: High Fylde MCZ IEFs: High	Subtidal habitat IEFs: Minor adverse Fylde MCZ IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Increased risk of INNS	✓	✓	✓	CoT65 CoT108 CoT109	C&O Subtidal habitat IEFs: Low Fylde MCZ IEFs: Low D Subtidal habitat IEFs: Low Fylde MCZ IEFs: Low	Subtidal habitat IEFs: Medium to High	C&O Subtidal habitat IEFs: Minor adverse Fylde MCZ IEFs: Minor adverse D Subtidal habitat IEFs: Minor adverse Fylde MCZ IEFs: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None

[a] C=construction, O=operation and maintenance, D=decommissioning. Differences in magnitude, sensitivity and significance are highlighted, otherwise the value given applies in all phases.

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Cumulative Effects Assessment Appendix

A.1.1.1.1 This appendix presents the full details of the CEA for temporary habitat disturbance/loss including a breakdown of the values associated with each of the projects associated with each scenario. This appendix is supplementary to the CEA tables presented in **section 2.13.2**.

A.1.2 Temporary habitat disturbance/loss

A.1.2.1 Scenario 1: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets

Construction phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.1.1 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.1.2 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.1.3 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.1.4 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.1.5 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.1.6 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Magnitude of impact

Subtidal habitat IEFs

A.1.2.1.7 The predicted cumulative temporary habitat loss/disturbance from the Transmission Assets and Morecambe Offshore Windfarm: Generation Assets during the construction phase would equate to 17.15 km^2. This includes all of the subtidal temporary habitat loss/disturbance described in **Table 2.12** associated with the construction of the Transmission Assets (14.81 km^2) together with up to 2.35 km^2 of temporary habitat disturbance/loss associated with the construction of the Morecambe Offshore Windfarm: Generation Assets (i.e. installation of OSPs, wind turbines and interconnector and inter-array cables; Morecambe Offshore Windfarm Ltd., 2024). The site preparation and construction of the Transmission Assets will take place over a maximum of 30 months (noting there is potential for a gap between the sequential construction periods for Morgan (21 months) and Morecambe (9 months)) and the

MDS assumes that this could occur sequentially with the Morgan Offshore Wind Project: Generation Assets which will be constructed over up to four years. Within the construction phases activities are anticipated to occur intermittently.

A.1.2.1.8 The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

A.1.2.1.9 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the magnitude of the cumulative impact is deemed to be medium and the sensitivity is considered to be medium. In accordance with the methodology for determining the significance of effects outlined in **section 2.10.4** and the matrix in **Table 2.16**, this correlates with a moderate adverse effect, however, this would only be applicable intermittently and for relatively short periods of time and will not extend beyond the construction phase. As outlined in **paragraphs 2.11.2.33** to **2.11.2.34**, the sediments and associated benthic communities are predicted to recover over time, typically within one to three years, and therefore no mitigation is required to reduce the significance of the effects. The overall significance of the effects in the medium to long term is **minor** adverse significance, which is not significant in EIA terms.

Operation and maintenance phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.1.10 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.1.11 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.1.12 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.1.13 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.1.14 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.1.15 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Magnitude of impact

Subtidal habitat IEFs

A.1.2.1.16 The predicted cumulative temporary habitat loss/disturbance from the Transmission Assets and Morecambe Offshore Windfarm: Generation Assets during the operation and maintenance phase would equate to 4.55 km^2. This includes all of the subtidal temporary habitat loss/disturbance described in **Table 2.12** associated with the operation and maintenance of the Transmission Assets (4.40 km^2) together with up to 0.16 km^2 of temporary habitat disturbance/loss associated with the operation and maintenance of the Morecambe Offshore Windfarm: Generation Assets (i.e. jack up events and repair and replacement for the interconnector and inter-array cables; Morecambe Offshore Windfarm Ltd., 2024). The maximum duration of the operational lifetime of the Transmission Assets is 35 years and maintenance works during this time for both the Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets will be intermittent and of short duration.

A.1.2.1.17 The cumulative effect is predicted to be of local spatial extent, long term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

A.1.2.1.18 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the sensitivity of the receptor is medium and the magnitude of the impact is low. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Decommissioning phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.1.19 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.1.20 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.1.21 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.1.22 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.1.23 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.1.24 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Magnitude of impact

Subtidal habitat IEFs

A.1.2.1.25 The predicted cumulative temporary habitat loss/disturbance from the Transmission Assets and Morecambe Offshore Windfarm: Generation Assets during the decommissioning phase may result in similar levels of disturbance as in the construction phase (**paragraph A.1.2.1.7**). This is, however, highly precautionary as the actual value is likely to be much lower as activities such as sandwave clearance may not be required during decommissioning.

A.1.2.1.26 The cumulative effect is predicted to be of local spatial extent, long term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

A.1.2.1.27 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the sensitivity of the receptor is medium and the magnitude of the impact is low. The effect will, therefore, be of **minor** adverse significance, which is not significant.

A.1.2.2 Scenario 2: Transmission Assets + Morgan Offshore Wind Project: Generation Assets

Construction phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.2.1 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.2.2 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.2.3 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.2.4 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.2.5 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.2.6 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Magnitude of impact

Subtidal habitat IEFs

A.1.2.2.7 The predicted cumulative temporary habitat loss/disturbance from the Transmission Assets and Morgan Offshore Wind Project: Generation Assets during the construction phase would equate to 76.23 km^2. This includes all of the subtidal temporary habitat loss/disturbance of 14.81 km^2 described in **Table 2.12** associated with the construction of the Transmission Assets together with up to 61.42 km^2 of temporary habitat disturbance/loss associated with the construction of the Morgan Offshore Wind Project: Generation Assets (i.e. installation of wind turbines, OSPs and interconnector and inter-array cables) (Morgan Offshore Wind Project Ltd., 2024). The construction of the Transmission Assets will take place over a maximum of 30 months (noting there is potential for a gap between the construction periods for Morgan (18 months) and Morecambe (6 months)) and the MDS assumes that this could occur sequentially with the Morgan Offshore Wind Project: Generation Assets which will be constructed over up to four years. Within the construction phases activities are anticipated to occur intermittently.

A.1.2.2.8 The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **medium**.

Significance of effect

Subtidal habitat IEFs

A.1.2.2.9 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the magnitude of the cumulative impact is deemed to be medium and the sensitivity is considered to be medium. In accordance with the methodology for determining the significance of effects outlined in **section 2.10.4** and the matrix in **Table 2.16**, this correlates with a moderate adverse effect, however, this would only be applicable intermittently and for relatively short periods of time, and will not extend beyond the construction phase. As outlined in **paragraphs 2.11.2.33** to **2.11.2.34**, the sediments and associated benthic communities are predicted to recover over time, typically within one to three years, and therefore no mitigation is required to reduce the significance of the effects. The overall significance of the effects in the medium to long term is **minor** adverse significance, which is not significant in EIA terms.

Operation and maintenance phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.2.10 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.2.11 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.2.12 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.2.13 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.2.14 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.2.15 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Magnitude of impact

Subtidal habitat IEFs

A.1.2.2.16 The predicted cumulative temporary habitat loss/disturbance from the Transmission Assets and Morgan Offshore Wind Project: Generation

Assets during the operation and maintenance phase would equate to 15.76 km^2. This includes all of the subtidal temporary habitat loss/disturbance described in **Table 2.12** associated with the operation and maintenance of the Transmission Assets (4.40 km^2) together with up to 11.36 km^2 of temporary habitat disturbance/loss associated with the construction of the Morgan Offshore Wind Project: Generation Assets (i.e. jack up events and repair and replacement for the interconnector and inter-array cables) (Morgan Offshore Wind Project Ltd., 2024). The maximum duration of the operational lifetime of the Transmission Assets is 35 years and maintenance works during this time for both the Transmission Assets and the Morgan Offshore Wind Project: Generation Assets will be intermittent and of short duration

A.1.2.2.17 The cumulative effect is predicted to be of local spatial extent, long term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

A.1.2.2.18 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the sensitivity of the receptor is medium and the magnitude of the impact is low. The effect will, therefore, be of **minor** adverse significance, which is not significant.

Decommissioning phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.2.19 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.2.20 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.2.21 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.2.22 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.2.23 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.2.24 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Magnitude of impact

Subtidal habitat IEFs

A.1.2.2.25 The predicted cumulative temporary habitat loss/disturbance from the Transmission Assets and Morgan Offshore Wind Project: Generation Assets during the decommissioning phase may result in similar levels of disturbance as in the construction phase (**paragraph A.1.2.2.7**). This is, however, highly precautionary as the actual value is likely to be much lower as activities such as sandwave clearance may not be required during decommissioning.

A.1.2.2.26 The cumulative effect is predicted to be of local spatial extent, long term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

A.1.2.2.27 Overall, for the subtidal IEFs **(**subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the sensitivity of the receptor is medium and the magnitude of the impact is low. The effect will, therefore, be of **minor** adverse significance, which is not significant.

A.1.2.3 Scenario 3: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets

Construction phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.3.1 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.3.2 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.3.3 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.3.4 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.3.5 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.3.6 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Magnitude of impact

Subtidal habitat IEFs

A.1.2.3.7 The predicted cumulative temporary habitat loss/disturbance from the Transmission Assets together with the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets during the construction phase would equate to 78.58 km^2. This includes all of the subtidal temporary habitat loss/disturbance of 14.81 km^2 as described in **Table 2.12** associated with the construction of the Transmission Assets together with up to 61.42 km^2 of temporary habitat disturbance/loss associated with the construction of the Morgan Offshore Wind Project: Generation Assets (i.e. installation of wind turbines, OSPs and inter-array and interconnector and export cables; Morgan Offshore Wind Ltd., 2023). The construction of the Morecambe Offshore Windfarms: Generation Assets may result in up to 2.35 m^2 of temporary habitat disturbance (i.e. installation of OSPs, wind turbines and interconnector and inter-array cables; Morecambe Offshore Windfarm Ltd., 2024). The construction of the Transmission Assets will take place over a maximum of 30 months (noting there is potential for a gap between the construction periods for Morgan (18 months) and Morecambe (6 months)). The MDS assumes that this could occur sequentially with the construction of the Morgan Offshore Wind Project: Generation Assets which could occur over up to four years and the Morecambe Offshore Windfarm: Generation Assets which could occur over up to 2.5 years. Within the construction phases activities are anticipated to occur intermittently.

A.1.2.3.8 The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **medium**.

Significance of effect

Subtidal habitat IEFs

A.1.2.3.9 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the magnitude of the cumulative impact is deemed to be medium and the sensitivity is considered to be medium. In accordance with the methodology for determining the significance of effects outlined in **section 2.10.4** and the matrix in **Table 2.16**, this correlates with a moderate adverse effect, however, this would only be applicable intermittently for relatively short periods of time and will not extend beyond the construction phase. As outlined in **paragraphs 2.11.2.33** to **2.11.2.34**, the sediments and associated benthic communities are predicted to recover over time, typically within one to three years, and therefore no mitigation is required to reduce the significance of the effects. The overall significance of the effects in the medium to long term is **minor** adverse significance, which is not significant in EIA terms.

Operation and maintenance phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.3.10 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.3.11 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.3.12 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.3.13 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.3.14 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.3.15 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Magnitude of impact

Subtidal habitat IEFs

A.1.2.3.16 The predicted cumulative temporary habitat loss/disturbance from the Transmission Assets together with the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets during the operations and maintenance phase would equate to up to 15.92 km^2. This includes all of the temporary habitat disturbance described in **Table 2.12** associated with the operations and maintenance of the Transmission Assets (4.40 km^2) together with up to 11.36 km^2 of temporary habitat disturbance/loss associated with the operations and maintenance of the Morgan Offshore Wind Project: Generation Assets (i.e. jack up events and repair and replacement for the interconnector and export cables; Morgan Offshore Wind Project Ltd., 2024). The operations and maintenance of the Morecambe

Offshore Windfarms Generation Assets may result in up to 0.16 km^2 of temporary habitat disturbance (i.e. jack up events and repair and replacement for the interconnector and inter-array cables; Morecambe Offshore Windfarm Ltd., 2024). This cumulative impact from the three projects will occur intermittently, with individual maintenance activities occurring over days to weeks, across the 35 year operational lifetime of the Transmission Assets.

A.1.2.3.17 The cumulative effect is predicted to be of local spatial extent, long term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

A.1.2.3.18 Overall, for the subtidal IEFs **(**subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the sensitivity of the receptor is medium and the magnitude of the impact is low. The effect will, therefore, be of **minor** adverse significance, which is not significant.

Decommissioning phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.3.19 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.3.20 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.3.21 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.3.22 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.3.23 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.3.24 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Magnitude of impact

Subtidal habitat IEFs

A.1.2.3.25 The predicted cumulative temporary habitat loss/disturbance from the Transmission Assets together with the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets during the decommissioning phase may result in similar levels of disturbance as in the construction phase (**paragraph A.1.2.3.7**). This is, however, highly precautionary as the actual value is likely to be much lower as activities such as sandwave clearance may not be required during decommissioning. The MDS for the decommissioning phase assumes the removal of cables and OSP foundations for both projects and also the removal of wind turbine foundations for the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets.

A.1.2.3.26 The cumulative effect is predicted to be of local spatial extent, long term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

A.1.2.3.27 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the sensitivity of the receptor is medium and the magnitude of the impact is low. The effect will, therefore, be of **minor** adverse significance, which is not significant.

A.1.2.3.28 Scenario 3: Morgan and Morecambe Offshore Windfarms: Transmission Assets + Morecambe Offshore Windfarm: Generation Assets and Morgan Offshore Wind Project: Generation Assets.

A.1.2.4 Scenario 4a: Scenario 3 (Transmission Assets and Generation Assets) + Tier 1

Construction phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.4.1 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance during decommissioning phase is as described for the construction phase in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.4.2 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.4.3 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.4.4 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.4.5 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.4.6 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Fylde MCZ

A.1.2.4.7 The sensitivities of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ are as described previously for the construction phase assessment in **paragraphs 2.11.2.17** and **2.11.2.22** and **Table 2.18**.

A.1.2.4.8 The sensitivities of the subtidal sand IEF and the subtidal mud IEF are **medium**.

Magnitude of impact

Subtidal habitat IEFs

A.1.2.4.9 Predicted cumulative temporary habitat loss/disturbance from each of the Tier 1 plans/projects/activities during the construction phase of the Transmission Assets is presented in **Table 2.25** together with a breakdown of the sources of this data from the relevant ESs and any assumptions made where necessary information was not presented in these ESs. **Table A. 1** shows that for all projects/plans/activities in the Tier 1 assessment (77.65 km^2), the cumulative temporary habitat loss/disturbance during the construction phase of the Transmission Assets, the Morgan Offshore Wind Project: Generation Assets and the Morecambe Offshore Windfarm: Generation Assets (78.58 km^2), is estimated at 156.23 km^2.

A.1.2.4.10 The maximum total temporary habitat loss/disturbance associated with all Tier 1 offshore windfarms (i.e. construction of Mona Offshore Wind Project, construction of the Awel y Môr Offshore Wind Farm, maintenance of Walney1, Walney 2, Walney Extension, Ormonde, West of Duddon Sands, Burbo Bank, Burbo Bank Extension, Gwynt Y Môr and Rhyl Flats offshore windfarms, maintenance and decommissioning of the Barrow and North Hoyle Offshore Windfarms) within the CEA benthic subtidal ecology study area is 72.33 km^2.

A.1.2.4.11 Temporary habitat loss/disturbance from Tier 1 dredge and disposal activities will be intermittent disturbance throughout the licenced period resulting in disturbance of approximately 4.23 km^2 of seabed spread over the overlap with the construction phase of Transmission Assets. There are also a number of dredge licences without readily available environmental information. The dredging associated with these projects is however of a small scale and is likely to occur intermittently throughout the Transmission Assets operations and maintenance phase affecting relatively small areas. One such example is Douglas Harbour on the Isle of Man which is plough dredged in both the inner and outer harbour annually with the silt deposited in a licenced site off Douglas Head.

A.1.2.4.12 The Isle of Man Interconnector project, which is scoped into this Tier 1 assessment, will involve maintenance or remedial work on cables. This project doesn't quantify the area affected by these activities (i.e. cable maintenance) however it is likely to be similar to those associated with the operations and maintenance activities at offshore wind farms resulting in low level intermittent disturbance throughout their licence period.

A.1.2.4.13 Additionally one oil and gas platform will be undergoing decommissioning during the construction phase of the Transmission Assets. The Millom West Platform will be cut 3 m below the level of the seabed and the wellheads will be removed (Burlington Resources, 2016). All equipment will be removed and any remaining pipelines will be filled with seawater and left buried in situ (Burlington Resources, 2016). These activities and they equipment required to undertake this decommissioning is likely to result in small and localised levels of disturbance to the seabed that will not significantly add to the total Tier 1 temporary habitat disturbance.

Table A. 1: Scenario 4a: Cumulative temporary habitat loss for the Transmission Assets construction phase, the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets and other Tier 1 plans/projects/activities in the CEA benthic subtidal and intertidal ecology study area.

Project	Predicated Temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
Transmission Assets	14.81	See **Table 2.12**	n/a
Morgan Offshore Wind Project: Generation Assets	61.42	Temporary habitat disturbance/loss may result from: • Jack-up events • Sandwave clearance • Cable installation • Foundation installation	Morgan Offshore Wind Ltd (2024)
Morecambe Offshore Windfarm: Generation Assets	2.35	Temporary habitat disturbance/loss may result from: • Jack-up events • Sandwave clearance • Cable installation	Morecambe Offshore Wind Ltd (2024)

Project	Predicated Temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
		• Foundation installation	
Offshore Renewables			
Walney Extension Offshore Windfarm	Operation and maintenance: 0.24	Temporary habitat disturbance/loss may result from: • Jack-up events.	Dong Energy (2013b)
West of Duddon Sands Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has not been considered in this licence.	RSKENSR Ltd (2006)
West of Duddon Sands Offshore Wind Farm – operations and maintenance licence (MLA/2016/00150/3)	0.001	Temporary habitat disturbance/loss may result from: • Jack-up events.	Dong Energy (2016c)
Mona Offshore Wind Project	Construction: 60.51	Temporary habitat disturbance/loss may result from: • Jack-up events; • Seabed preparation; • Wind turbine and OSP installation; • Cable installation; • Scour protection and cable protection installation.	Mona Offshore Wind Ltd. (2024)
Walney 2 Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has not been considered in this licence.	Dong Energy (2006)
Walney 1 Offshore Wind farm – operations and maintenance marine licences (MLA/2014/00028/5, MLA/2017/00081/2, MLA/2014/00027/7, MLA/2013/00426/2 and MLA/2016/00151/3)	1.13	Temporary habitat disturbance/loss may result from: • Cable repair/remediation; • Jetting for cable repair and/or remediation works; and • Jack-up/moored vessels.	Dong Energy (2014b) Marine Space (2017a) Dong Energy (2013c) Dong Energy (2016b)

Project	Predicated Temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
Walney 2 Offshore Wind Farm – operations and maintenance marine licences	0.24	Temporary habitat disturbance/loss may result from: • Jack-up events.	Dong Energy (2013b)
Walney 1 Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has not been considered in this licence.	Dong Energy (2006)
Barrow Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has not been considered in this licence.	Warwick Energy (2005)
	Decommissioning: No quantification provided.	Potential total removal of wind turbines, scour protection and subsea cables.	
Barrow Offshore Wind Farm – operations and maintenance marine licences (MLA/2016/00149/3) (MLA/2015/00077)	0.07	Temporary habitat disturbance/loss may result from: • Jetting for cable repair and/or remediation works; and • Jack-up/moored vessels.	Marine Space (2015a) Dong Energy (2016a)
Routine operations and maintenance activities at five OSPs (Barrow, Ormonde, Lincs, Westermost Rough, and Gunfleet Sands) (MLA/2017/00100/1)	No quantification provided.	Temporary habitat disturbance/loss may result from: • Removal of algal growth.	Transmission Capital Partners Ltd (2017)
Ormonde Offshore Wind Farm – operations and maintenance marine licences (MLA/2016/00224/2) (MLA/2015/00086/2)	0.07	Temporary habitat disturbance/loss may result from: • Jetting for cable repair and/or remediation works; and • Jack-up events.	Marine Space (2015b) Vattenfall Wind Power Ltd (2016)
Burbo Bank Extension Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has	Seascape Energy (2002)

Project	Predicated Temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
		not been considered in this licence.	
Burbo Bank Extension – operations and maintenance marine licences (MLA/2017/00164) (MLA/2017/00166/1)	0.03	Temporary habitat disturbance/loss may result from: • Cable repair/remediation.	Dong Energy (2017b) Dong Energy (2017c)
Burbo Bank Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has not been considered in this licence.	Seascape Energy (2002)
Burbo Bank Offshore Wind Farm – operations and maintenance marine licences (MLA/2016/00406) (MLA/2014/00336/1)	0.01	Temporary habitat disturbance/loss may result from: • Cable repair/remediation.	Dong Energy (2017a) Dong Energy (2014)
Gwynt y Mor Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss may result from: • Component repairs and replacement; and • Biofouling removal.	CMACS (2005b)
Awel y Môr Offshore Wind Farm	Construction: 10.02	Temporary habitat disturbance/loss may result from: • Jack up events; • Anchoring; and • Intertidal HDD.	REW (2022)
Ormonde Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has not been considered in this licence.	Eclipse Energy Company Ltd (2005)
North Hoyle Offshore Wind Farm	Operation and maintenance: No quantification provided.	No significant impacts on benthic communities would arise from operation of the North Hoyle Offshore Wind Farm.	North Hoyle (2002)
	Decommissioning: No quantification provided.	Potential total removal of wind turbines and scour protection.	

Project	Predicated Temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
North Hoyle Offshore Wind Farm – operations and maintenance marine licences	No quantification provided.	No detail provided.	n/a
Rhyl Flats Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has not been considered in this licence.	Celtic Offshore Wind Ltd (2002)
	Decommissioning: No quantification provided.	Temporary habitat disturbance/loss may result from: • Infrastructure removal.	
Rhyl Flats Offshore Wind Farm – operations and maintenance marine licences	No quantification provided.	No detail provided.	NRW (2015)
Deposit and removal			
Hilbre Swash (392/393)	0.86	Temporary habitat disturbance/loss may result from: • Aggregate extraction (mainly sand). The values provided for this project represent the area of the project as no temporary habitat disturbance/loss values were provided.	NRW (2013)
Dredging activities and dredge disposal sites			
Liverpool 2 and River Mersey Approach Channel Dredging	3.71	Temporary habitat disturbance/loss may result from: • Dredging of silt. The values provided for this project represent the area of the project as no temporary habitat disturbance/loss values were provided.	Royal Haskoning (2012)
Mersey channel and river maintenance dredge disposal renewal (MLA/2021/00202)	0.5	Temporary habitat disturbance/loss may result from: • Dredging of silt and sand.	Royal Haskoning (2018)

Project	Predicated Temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
RNLI North Division - Regional Licence for Low Impact Maintenance Works	No quantification provided.	Temporary habitat disturbance/loss may result from: • Maintenance works on slipways and other coastal locations.	n/a
Walney Extension pontoon/jetty dredging and disposal	0.01	Temporary habitat disturbance/loss may result from: • Material deposition.	Orsted (2018)
Douglas Harbour, Isle of Man	No quantification provided.	Annual maintenance dredging of the harbour.	n/a
Port of Barrow maintenance dredging disposal licence (MLA/2015/00458/1)	0.01	Temporary habitat disturbance/loss may result from: • Dredging of silt, sand and gravel. The values provided for this project represent the area of the project as no temporary habitat disturbance/loss values were provided.	Associated British Ports (2016)
West of Duddon Sands pontoon dredging marine licence	No quantification provided.	Temporary habitat disturbance/loss may result from: • Material deposition.	n/a
Annual Maintenance Dredging Peel Harbour Isle of Man	No quantification provided.	Annual maintenance dredging of the harbour.	n/a
Remedial works			
Isle of Man Interconnector Cable – cable protection remedial works	No quantification provided.	Temporary habitat disturbance/loss may result from: • Anchoring; and • Concrete mattress installation.	Intertek (2014)
Isle of Man to UK Interconnector Cable – maintenance and repair	No quantification provided.	Temporary habitat disturbance/loss may result from: • Cable repair/reburial.	Intertek (2016)
Oil and Gas			

Project	Predicated Temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
Isle of Man Crogga licence	No quantification provided.	Temporary habitat disturbance/loss may result from: • Geophysical and geotechnical studies; and • Exploratory drilling for an appraisal well.	Isle of Man Government (2021)
Millom West Platform-decommissioning	No quantification provided.	Temporary habitat disturbance/loss may result from: • Removal of platform infrastructure.	Burlington Resources (2016)
Total (km^2)	156.23		

2.17.1.2 The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **medium**.

Fylde MCZ

A.1.2.4.14 The only Tier 1 project that will interact with the Fylde MCZ is the repair and remediation work for the Isle of Man Interconnector project which will result in low levels of temporary habitat disturbance of a magnitude similar to the operation and maintenance work undertaken for the Transmission Assets.

A.1.2.4.15 The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

A.1.2.4.16 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the magnitude of the cumulative impact is deemed to be medium and the sensitivity of the receptor is considered to be medium. In accordance with the methodology for determining the significance of effects outlined in **section 2.10.4** and the matrix in **Table 2.16**, this correlates with a moderate adverse effect, however, this would only be applicable intermittently and for relatively short periods of time and will not extend beyond the construction phase. As outlined in **paragraphs 2.11.2.33** to **2.11.2.34**, the sediments and associated benthic communities are predicted to recover over time, and therefore no mitigation is required to reduce the significance of the effects. The overall significance of the effects in the medium to long term is **minor adverse** significance, which is not significant in EIA terms.

Fylde MCZ

A.1.2.4.17 Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Operation and maintenance phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.4.18 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance during operation and maintenance phase is as described for the construction phase in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.4.19 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.4.20 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.4.21 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.4.22 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.4.23 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Fylde MCZ

A.1.2.4.24 The sensitivities of the subtidal sand IEF and the subtidal mud IEF of the Fylde MCZ are as described previously for the construction phase assessment in **paragraphs 2.11.2.17** and **2.11.2.22** and **Table 2.18**.

A.1.2.4.25 The sensitivities of the subtidal sand IEF and the subtidal mud IEF are **medium**.

Magnitude of impact

Subtidal habitat IEFs

A.1.2.4.26 Predicted cumulative temporary habitat loss/disturbance from each of the Tier 1 plans/projects/activities are presented in **Table A.2** together with a breakdown of the sources of this data from the relevant ESs and any assumptions made where necessary information was not presented in these ESs. **Table 2.25** shows that the cumulative temporary habitat loss/disturbance during the operations and maintenance phase of the Transmission Assets is estimated at 53.11 km^2 (including the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets).

A.1.2.4.27 The maximum total temporary habitat loss/disturbance associated with all other offshore wind farms, which are in their operations and maintenance and/or decommissioning phases, within the Tier 1 assessment is 36.69 km^2. The values of temporary habitat loss for Transmission Assets are comparably larger than for many of the other offshore wind farms presented in **Table A.2**, as many do not quantify the temporary habitat disturbance in the operations and maintenance phase or break it down in to a number of different licences which are active over different periods of the wind farms lifetime.

A.1.2.4.28 Additionally one oil and gas platform will be undergoing decommissioning during the operations and maintenance phase of the Morgan Offshore Wind Project: Generation Assets. The Millom West Platform will be cut 3 m below the level of the seabed and the wellheads will be removed (Burlington Resources, 2016). All equipment will be removed and any remaining pipelines will be filled with seawater and left buried in situ (Burlington Resources, 2016). These activities and they equipment required to undertake this decommissioning is likely to result in very small and localised levels of disturbance to the seabed.

A.1.2.4.29 Temporary habitat loss/disturbance from Tier 1 dredge and disposal activities will be intermittent disturbance throughout the licenced period resulting in disturbance of approximately 0.50 km^2 of seabed spread over the overlap with the operations and maintenance phase of Transmission Assets. There are also a number of dredge licences without readily available environmental information (i.e. Douglas Harbour dredging Isle of Man, maintenance dredging Peel Harbour Isle of Man and Mersey channel and river maintenance dredge disposal renewal). The dredging associated with these projects is however of a small scale and is likely to occur intermittently throughout the Transmission Assets operations and maintenance phase affecting relatively small areas. One such example is Douglas Harbour on the Isle of Man which is plough dredged in both the inner and outer harbour annually with the silt deposited in a licenced site off Douglas Head.

A.1.2.4.30 There are a number of cables and pipelines in the Transmission Assets CEA benthic subtidal ecology study area, some of which will require maintenance during the operation and maintenance phase of the Transmission Assets. The one project scoped into this Tier 1 assessment due to having a direct overlap with the Transmission Assets, is the Isle of Man Interconnector Cable, which may require maintenance or remedial work during the Transmission Assets operation and maintenance phase. This project does not quantify the area affected by these activities however it is likely to be similar to those associated with maintenance activities for cables at offshore wind farms resulting in low level intermittent disturbance throughout its licence period.

Table A.2: Scenario 4a: Cumulative temporary habitat loss for the Transmission Assets operation and maintenance phase, the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets and other Tier 1 plans/projects/activities in the CEA benthic subtidal and intertidal ecology study area.

Project	Predicted temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
Transmission Assets	4.40	See **Table 2.12**	n/a
Morgan Offshore Wind Project: Generation Assets	11.36	Temporary habitat disturbance/loss may result from: • Jack-up events • Sandwave clearance • Cable installation • Foundation installation	Morgan Offshore Wind Ltd (2024)
Morecambe Offshore Windfarm: Generation Assets	0.16	Temporary habitat disturbance/loss may result from: • Jack-up events • Sandwave clearance • Cable installation • Foundation installation	Morecambe Offshore Wind Ltd (2024)
Offshore renewables			
Walney Extension	Operation and maintenance: 0.24	Temporary habitat disturbance/loss may result from: • Jack-up events.	Dong Energy (2013b)
	Decommissioning: 1.43		
West of Duddon Sands Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has not been considered in this licence.	RSKENSR Ltd (2006)
	Decommissioning: 0.68	Temporary habitat disturbance/loss may result from: • Jack-up events.	

Project	Predicted temporary habitat disturbance/loss (km²)	Component parts of temporary habitat disturbance/loss	Source
West of Duddon Sands Offshore Wind Farm operations and maintenance marine licence (MLA/2016/00150/3)	0.001	Temporary habitat disturbance/loss may result from: • Jack-up events.	Dong Energy (2016c)
Mona Offshore Wind Project	Operation and maintenance: 17.40	Temporary habitat disturbance/loss may result from: • Jack-up events; • Wind turbine and OSP maintenance; and • Cable repair and reburial.	Mona Offshore Wind Ltd. (2024)
Walney 1 Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has not been considered in this licence.	Dong Energy (2006)
	Decommissioning: 1.13	Temporary habitat disturbance/loss may result from: • Jack-up events; • Foundation removal; and • Scour protection removal.	
Walney 1 Offshore Wind Farm – operations and maintenance marine licences	0.05	Temporary habitat disturbance/loss may result from: • Cable repair/remediation; • Jetting for cable repair and/or remediation works; and • Jack-up/moored vessels.	Dong Energy (2014b)
Walney 2 Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has not been considered in this licence.	Dong Energy (2006)
	Decommissioning: 0.09	Temporary habitat disturbance/loss may result from: • Jack-up events; • Foundation removal; and • Scour protection removal.	

Project	Predicted temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
Walney 2 Offshore Wind–Farm–- operations and maintenance marine licences (MLA/2017/00429/1)	0.01	Temporary habitat disturbance/loss may result from: • Cable repair/remediation.	Orsted (2018)
Ormonde Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has not been considered in this licence.	Eclipse Energy Company Ltd (2005)
	Decommissioning: 5.25	Temporary habitat disturbance/loss may result from: • Removal of wind turbines; and • Removal of scour protection.	
Ormonde Offshore Wind Farm – operations and maintenance marine licences (MLA/2015/00086/2 and MLA/2016/00224/2)	0.07	Temporary habitat disturbance/loss may result from: • Jetting for cable repair and/or remediation works; and • Jack-up/moored vessels.	Marine Space (2015b) Vattenfall Wind Power Ltd (2016)
Burbo Bank Extension Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has not been considered in this licence.	Seascape Energy (2002)
	Decommissioning: No quantification provided.	Temporary habitat disturbance/loss may result from: • Jack-up events.	
Burbo Bank Extension Offshore Wind–Farm–- operations and maintenance marine licences (MLA/2017/00164) (MLA/2017/00166/1)	0.03	Temporary habitat disturbance/loss may result from: • Cable repair/remediation.	Dong Energy (2017b) Dong Energy (2017c)
Burbo Bank Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operation and maintenance phase has not been considered in this licence.	Seascape Energy (2002)

Project	Predicted temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
	Decommissioning: 0.02	Temporary habitat disturbance/loss may result from: • Wind turbine and scour protection removal.	
Burbo Bank Offshore Wind–Farm–-operations and maintenance marine licences (MLA/2016/00406) (MLA/2014/00336/1)	0.01	Temporary habitat disturbance/loss may result from: • Cable repair/remediation.	Dong Energy (2017a) Dong Energy (2014)
Gwynt y Mor Offshore Wind Farm	Operation and maintenance: No quantification provided.	Temporary habitat disturbance/loss may result from: • Component repairs and replacement; and • Biofouling removal.	CMACS (2005b)
	Decommissioning: No quantification provided.	Temporary habitat disturbance/loss may result from: • Jack up events.	
Awel y Môr Offshore Wind Farm	Operation and maintenance: 0.258	Temporary habitat disturbance/loss may result from: • Cable repair/reburial.	RWE (2022)
	Decommissioning: 10.02	Temporary habitat disturbance/loss may result from: • Jack-up events; and • Anchoring.	
North Hoyle Offshore Wind Farm	Operation and maintenance: No quantification provided.	No significant impacts on benthic communities would arise from operation of the North Hoyle Offshore Wind Farm.	North Hoyle (2002)
	Decommissioning: No quantification provided.	Potential total removal of wind turbines and scour protection.	
Dredging projects			
Annual Maintenance Dredging Peel Harbour Isle of Man	n/a	Annual maintenance dredging of the harbour.	n/a

Project	Predicted temporary habitat disturbance/loss (km²)	Component parts of temporary habitat disturbance/loss	Source
Douglas Harbour dredging Isle of Man	n/a	Annual maintenance dredging of the harbour.	n/a
Mersey channel and river maintenance dredge disposal renewal	0.5	Temporary habitat disturbance/loss may result from: • Dredging of silt and sand.	Royal Haskoning (2018)
Remedial work			
Isle of Man to UK Interconnector –able–-maintenance and repair (x2)	n/a	Temporary habitat disturbance/loss may result from: • Cable repair/reburial.	Intertek (2016)
Oil and gas			
Isle of Man Crogga licence	No quantification provided.	Temporary habitat disturbance/loss may result from: • Geophysical and geotechnical studies; and • Exploratory drilling for an appraisal well.	Isle of Man Government (2021)
Millom West Platform-decommissioning	No quantification provided.	Temporary habitat disturbance/loss may result from: • Removal of platform infrastructure.	Burlington Resources (2016)
Total (km²)	53.11		

A.1.2.4.31 The cumulative effect is predicted to be of regional spatial extent, long term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Fylde MCZ

A.1.2.4.32 The only Tier 1 project that will interact with the Fylde MCZ is the repair and remediation work for the Isle of Man Interconnector project which will result in low levels of temporary habitat disturbance of a magnitude similar to the operation and maintenance work undertaken for the Transmission Assets.

A.1.2.4.33 The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

A.1.2.4.34 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively localised scale of this potential impact in this phase of the Transmission Assets as well as the small scale of the disturbance expected.

Fylde MCZ

A.1.2.4.35 Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Decommissioning phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.4.36 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance during decommissioning phase is as described for the construction phase in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.4.37 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.4.38 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.4.39 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.4.40 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.4.41 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Magnitude of impact

Subtidal habitat IEFs

A.1.2.4.42 During the decommissioning phase of the Transmission Assets as well as Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets is the Mona Offshore Wind Project which will also be in its decommissioning phase. The maximum total temporary habitat disturbance/loss associated with the Mona Offshore Wind Project within the Transmission Assets CEA subtidal ecology study area within the decommissioning phase is estimated to be the same as for the construction phase (**paragraphs A.1.2.4.9** to **2.17.1.2**). This is, however, likely to be an over estimation as the decommissioning phase will not include site preparation activities such as sand wave clearance which account for a large amount of temporary habitat loss/disturbance in the construction phase. For all of these projects, decommissioning is over 35 years away making it difficult to determine the regulations and guidelines which will govern this process in the future making it difficult to determine a more specific number for this phase.

A.1.2.4.43 The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

A.1.2.4.44 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively localised scale of this potential impact in this phase of the Transmission Assets as well as the small scale of the disturbance expected.

A.1.2.5 Scenario 4b: Scenario 4a + Tier 2

Construction phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.5.1 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the

Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.5.2 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.5.3 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.5.4 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.5.5 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.5.6 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Fylde MCZ IEFs

A.1.2.5.7 There are no tier 2 projects which spatially overlap with the Fylde MCZ, therefore no tier 2 assessment of the impact on the Fylde MCZ is required for any phase beyond the assessment for scenario 4a.

Magnitude of impact

Subtidal habitat IEFs

A.1.2.5.8 The maximum total temporary habitat disturbance/loss associated with the Tier 2 projects includes the Eni Hynet CCS and the Liverpool Bay area 457 aggregate extraction site. The maximum total temporary habitat disturbance/loss associated with the Tier 2 projects is estimated at up to 3.24 km^2 (**Table A. 3**), which alongside Scenario 4a gives a cumulative total of 159.47 km^2.

A.1.2.5.9 The Liverpool Bay area 457 aggregate extraction site may be licenced during the construction phase of the Transmission Assets. A scoping report for this area suggests a 15-year licencing period which would allow for the extraction of 18 Mt of marine aggregates with an annual extraction rate of 1.2 Mt (Westminster Gravels Ltd, 2023).

A.1.2.5.10 A scoping report is available for the ENI Hynet CCS project which outlines the impact on benthic ecology from temporary habitat disturbance/loss may result from site preparation activities and the installation, maintenance, refurbishment, and removal of development infrastructure (subsea cable and pipeline installation, temporary oil platform refurbishment, drill cutting deposits, jack-up vessel and drill rig spud deployments) (Liverpool Bay CCS Ltd, 2022). The scoping report does not however provide estimates of habitat disturbance with which to make any quantitative assessment of the cumulative impact with the Transmission Assets.

Table A. 3: Scenario 4b: Cumulative temporary habitat loss for the Transmission Assets construction phase, the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets and other Tier 2 plans/projects/activities in the CEA benthic subtidal and intertidal ecology study area.

Project	Predicated Temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
Scenario 4a	156.23	See **Table A. 1**	n/a
CCS projects			
ENI Hynet CCS	No quantification provided.	Temporary habitat disturbance/loss may result from: • Site preparation; • Cable installation; and • Maintenance activities.	Liverpool Bay CCS Ltd (2022)
Deposit and removal			
Liverpool Bay aggregate extraction area 457	3.24	Temporary habitat disturbance/loss may result from: • Aggregate extraction.	Westminster Gravels Ltd (2023)
Total (km^2)	159.47		

A.1.2.5.11 The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **medium**.

Significance of effect

Subtidal habitat IEFs

A.1.2.5.12 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the magnitude of the cumulative impact is deemed to be medium and the sensitivity of the receptor is considered to be medium. In accordance with the methodology for determining the significance of effects outlined in **section 2.10.4** and the matrix in **Table 2.16**, this correlates with a moderate adverse effect, however, this would only be applicable intermittently and for relatively short periods of time and will not extend beyond the construction phase. As outlined in **paragraphs 2.11.2.33** to **2.11.2.34**, the sediments and associated benthic communities are predicted to recover over time, and therefore no mitigation is required to reduce the significance of the effects. The overall significance of the effects in the medium to long term is **minor adverse** significance, which is not significant in EIA terms.

Operation and maintenance phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.5.13 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.5.14 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.5.15 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.5.16 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.5.17 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.5.18 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Fylde MCZ IEFs

A.1.2.5.19 There are no tier 2 projects which spatially overlap with the Fylde MCZ, therefore no tier 2 assessment of the impact on the Fylde MCZ is required for any phase beyond the assessment for scenario 4a.

Magnitude of impact

Subtidal habitat IEFs

A.1.2.5.20 The maximum total temporary habitat disturbance/loss associated with the Scenario 4a projects and the Tier 2 projects during the operations and maintenance phase is estimated at up to 55.68 km^2 (see **Table A. 4**).

A.1.2.5.21 A scoping report is available for the Mooir Vannin Offshore Windfarm (Ørsted, 2023). This report does not specify the impacts which will be assessed in association with the project however it does provide some of the parameters of the project including that up to 100 turbines may be installed as well as up to five OSPs and 490 km of inter-array cables, 100 km of interconnector cables, 90 km of offshore electrical connection cables and 125 km of export cables may also be installed which will result in habitat disturbance (Ørsted, 2023). Additionally regular maintenance is expected to occur on infrastructure throughout the lifetime of the project (Ørsted, 2023).

A.1.2.5.22 The Liverpool Bay area 457 aggregate extraction site may be licenced during the construction phase of the Transmission Assets. A scoping report for this area suggests a 15-year licencing period which would allow for the extraction of 18 Mt of marine aggregates with an annual extraction rate of 1.2 Mt (Westminster Gravels Ltd, 2023).

A.1.2.5.23 A scoping report is available for the ENI Hynet CCS project which outlines the impact on benthic ecology from temporary habitat disturbance/loss may result from site preparation activities and the installation, maintenance, refurbishment, and removal of development infrastructure (subsea cable and pipeline installation, temporary oil platform refurbishment, drill cutting deposits, jack-up vessel and drill rig spud deployments) (Liverpool Bay CCS Ltd, 2022). The scoping report does not however provide estimates of habitat disturbance with which to make any quantitative assessment of the cumulative impact with the Transmission Assets.

Table A. 4: Scenario 4b: Cumulative temporary habitat loss for the Transmission Assets operation and maintenance phase, the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets and other Tier 2 plans/projects/activities in the CEA benthic subtidal and intertidal ecology study area.

Project	Predicated Temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
Scenario 4a	53.11	See **Table A. 1**	n/a
Renewable energy			
Mooir Vannin Offshore Windfarm	No quantification provided.	Temporary habitat disturbance/loss may result from: • Wind turbine and OSP; • Foundation installation; • Cable installation activities; and • Maintenance activities.	Ørsted (2023)
CCS projects			
ENI Hynet CCS	No quantification provided.	Temporary habitat disturbance/loss may result from:	Liverpool Bay CCS Ltd (2022)

Project	Predicated Temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
		• Site preparation; • Cable installation; and • Maintenance activities.	
Deposit and removal			
Liverpool Bay aggregate extraction area 457	2.57	Temporary habitat disturbance/loss may result from: • Aggregate extraction.	Westminster Gravels Ltd (2023)
Total (km^2)	55.68		

A.1.2.5.24 The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

A.1.2.5.25 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively localised scale of this potential impact in this phase of the Transmission Assets as well as the small scale of the disturbance expected.

Decommissioning phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.5.26 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.5.27 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.5.28 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.5.29 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.5.30 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

2.17.1.3 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Fylde MCZ IEFs

A.1.2.5.31 There are no tier 2 projects which spatially overlap with the Fylde MCZ, therefore no tier 2 assessment of the impact on the Fylde MCZ is required for any phase beyond the assessment for scenario 4a.

Magnitude of impact

Subtidal habitat IEFs

A.1.2.5.32 During the decommissioning phase of the Transmission Assets all Tier 2 projects (i.e. Mooir Vannin Offshore Windfarm and Eni Hynet CCS) have the potential to also be in their decommissioning phase, however the licence for the Liverpool Bay area 457 aggregate extraction will have expired. The maximum total temporary habitat disturbance/loss associated with the Tier 2 projects within the Transmission Assets CEA subtidal and intertidal ecology study area within the decommissioning phase is estimated to be the same as for the construction phase (**paragraphs A.1.2.5.8** to **A.1.2.5.11**) with the addition of the Mooir Vannin maintenance activities. This is, however, likely to be an over estimation as the decommissioning phase will not include site preparation activities such as sand wave clearance which account for a large amount of temporary habitat loss/disturbance in the construction phase. For all of these projects, decommissioning is over 35 years away making it difficult to determine the regulation and guidelines which will govern this process in the future making it difficult to determine a more specific number for this phase.

A.1.2.5.33 The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

A.1.2.5.34 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively localised scale of this potential impact in this phase of the Transmission Assets as well as the small scale of the disturbance expected.

A.1.2.6 Scenario 4c: Scenario 4b + Tier 3

Construction phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.6.1 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.6.2 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.6.3 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.6.4 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.6.5 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.6.6 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Fylde MCZ IEFs

A.1.2.6.7 There are no tier 3 projects which spatially overlap with the Fylde MCZ, therefore no tier 3 assessment of the impact on the Fylde MCZ is required for any phase beyond the assessment for scenario 4a.

Magnitude of impact

Subtidal habitat IEFs

A.1.2.6.8 Two Tier 3 projects which has been identified in the CEA with the potential to result in cumulative temporary habitat loss/disturbance during the construction phase of the Transmission Assets, the MaresConnect interconnector cable and the Isle of Man – UK Interconnector 2. There is, however, currently no information on the impact that either interconnector cable will have on benthic ecology receptors.

A.1.2.6.9 The activities associated with the MaresConnect interconnector cable which are likely to result in temporary habitat disturbance/loss are similar to those expected for the installation of cables for the Transmission Assets. Construction is likely to occur in 2025 and the Transmission Assets is anticipated to become operational in 2027 (MaresConnect, 2022), although it should be noted that these timeframes are only indicative at this stage. The construction activities are likely to involve cable installation such as jet trenching and the installation of cable protection. Maintenance activities are likely to involve the repair and reburial of cables.

A.1.2.6.10 No formal timetable has been established for the Isle of Man – UK Interconnector 2 however it has been suggested the cable be installed as early as 2028 (Isle of Man Today, 2023), although it should be noted that these timeframes are only indicative at this stage. The construction activities are likely to involve cable installation such as jet trenching and the installation of cable protection. Maintenance activities are likely to involve the repair and reburial of cables.

A.1.2.6.11 The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **medium**.

Significance of effect

Subtidal habitat IEFs

A.1.2.6.12 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the magnitude of the cumulative impact is deemed to be medium and the sensitivity of the receptor is considered to be medium. In accordance with the methodology for determining the significance of effects outlined in **section 2.10.4** and the matrix in **Table 2.16**, this correlates with a moderate adverse effect, however, this would only be applicable intermittently and for relatively short periods of time and will not extend beyond the construction phase. As outlined in **paragraphs 2.11.2.33** to **2.11.2.34**, the sediments and associated benthic communities are predicted to recover over time, and therefore no mitigation is required to reduce the significance of the effects. The overall significance of the effects in the medium to long term is **minor adverse** significance, which is not significant in EIA terms.

Operation and maintenance phase

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.2.6.13 The sensitivity of the subtidal habitat IEFs to temporary habitat disturbance is as described for the construction phase of the

Transmission Assets alone assessment in **paragraphs 2.11.2.4** to **2.11.2.16** and **Table 2.18**.

A.1.2.6.14 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF is **medium**.

A.1.2.6.15 The sensitivity of the brittlestar beds IEF is **medium**.

A.1.2.6.16 The sensitivity of the subtidal muddy sands with relatively species poor benthic communities IEF is **medium**.

A.1.2.6.17 The sensitivity of the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF is **medium**.

A.1.2.6.18 The sensitivity of the seapens and burrowing megafauna communities IEF is **high** (and reduced to **medium** in the absence of seapens).

Fylde MCZ IEFs

A.1.2.6.19 The sensitivity of the Fylde MCZ IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.17** to **2.11.2.22** and **Table 2.18**.

A.1.2.6.20 The subtidal sand IEF of the Fylde MCZ is deemed to be of medium vulnerability, high recoverability, and national value. The sensitivity of the receptor is therefore considered to be **medium**.

A.1.2.6.21 The subtidal mud IEF of the Fylde MCZ is deemed to be of very high vulnerability and high to medium recoverability, and of national importance. The sensitivity of the receptor is therefore considered to be **medium**.

Magnitude of impact

Subtidal habitat IEFs

A.1.2.6.22 Two Tier 3 projects which has been identified in the CEA with the potential to result in cumulative temporary habitat loss/disturbance during the operation and maintenance phase of the Transmission Assets, the MaresConnect interconnector cable and the Isle of Man – UK Interconnector 2. There is, however, currently no information on the impact that either interconnector cable will have on benthic ecology receptors.

A.1.2.6.23 The activities associated with the MaresConnect interconnector cable which are likely to result in temporary habitat disturbance/loss are similar to those expected for the installation of cables for the Transmission Assets. Construction is likely to occur in 2025 and the project is anticipated to become operational in 2027 (MaresConnect, 2022), although it should be noted that these timeframes are only indicative at this stage. The construction activities are likely to involve cable installation such as jet trenching and the installation of cable protection. Maintenance activities are likely to involve the repair and reburial of cables.

A.1.2.6.24 No formal timetable has been established for the Isle of Man – UK Interconnector 2 however it has been suggested the cable be installed as early as 2028 (Isle of Man Today, 2023), although it should be noted that these timeframes are only indicative at this stage. The construction activities are likely to involve cable installation such as jet trenching and the installation of cable protection. Maintenance activities are likely to involve the repair and reburial of cables.

A.1.2.6.25 The Mooir Vannin – UK Transmission Assets are likely to be constructed and become operational in the operation and maintenance phase of the Transmission Assets. Based on current information the Mooir Vannin – UK Transmission Assets is likely to of comprise multiple HVAC or HVDC cables, with a landfall at Penwortham, and could potentially include a booster station if HVAC cables are utilised (Mooir Vannin Offshore Wind Farm Limited, 2024). Maintenance activities with the potential to result in temporary habitat disturbance would likely involve the repair and reburial of cables.

A.1.2.6.26 The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Fylde MCZ IEFs

A.1.2.6.27 There is the potential for both the Mooir Vannin – UK Transmission Assets and the Isle of Man to UK Interconnector 2 to overlap with the Fylde MCZ and result in disturbance to the designated features during maintenance activities. The information currently available however doesn't allow for a more detailed assessment of the impacts of these projects.

A.1.2.6.28 The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

A.1.2.6.29 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively localised scale of this potential impact in this phase of the Transmission Assets as well as the small scale of the disturbance expected.

Fylde MCZ IEFs

A.1.2.6.30 Overall, for the Fylde MCZ IEFs (subtidal sand IEF and subtidal mud IEF) the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.

Decommissioning phase

Sensitivity of the receptor

Fylde MCZ IEFs

A.1.2.6.31 The sensitivity of the Fylde MCZ IEFs to temporary habitat disturbance is as described for the construction phase of the Transmission Assets alone assessment in **paragraphs 2.11.2.17** to **2.11.2.22** and **Table 2.18**.

A.1.2.6.32 The subtidal sand IEF of the Fylde MCZ is deemed to be of medium vulnerability, high recoverability, and national value. The sensitivity of the receptor is therefore considered to be **medium**.

A.1.2.6.33 The subtidal mud IEF of the Fylde MCZ is deemed to be of very high vulnerability and high to medium recoverability, and of national importance. The sensitivity of the receptor is therefore considered to be **medium**.

Magnitude of impact

Subtidal habitat IEFs and

A.1.2.6.34 There is one Tier 3 project which has been identified in the CEA with the potential to result in cumulative temporary habitat loss/disturbance during the decommissioning phase of the Transmission Assets, the Mooir Vannin – UK Transmission Assets.

A.1.2.6.35 During the decommissioning phase of the Transmission Assets the Mooir Vannin – UK Transmission Assets are likely to be in their operation and maintenance phase. The activities involved in this phase of the project are likely to involve the repair and reburial of cable as well as any structural maintenance to the booster station resulting in disturbance at a similar magnitude to the Transmission Assets.

A.1.2.6.36 The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.

Fylde MCZ IEFs

A.1.2.6.37 There is the potential for the Mooir Vannin – UK Transmission Assets to overlap with the Fylde MCZ and result in disturbance to the designated features during maintenance activities. The information currently available however doesn’t allow for a more detailed assessment of the impact of this project.

A.1.2.6.38 The cumulative effect is predicted to be of local spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.

Significance of effect

Subtidal habitat IEFs

A.1.2.6.39 Overall, for the subtidal IEFs (subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal muddy sands with relatively species poor benthic communities IEF, the subtidal sandy sediments characterised by relatively diverse infaunal and epifaunal benthic communities IEF, the brittlestar beds IEF and seapens and burrowing megafauna communities IEF) the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This has been concluded due to the relatively localised scale of this potential impact in this phase of the Transmission Assets as well as the small scale of the disturbance expected.

Fylde MCZ IEFs

A.1.2.6.40 Overall, for the Fylde MCZ IEFs (subtidal sand IEF and subtidal mud IEF) the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.