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MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Environmental Statement

Volume 2, Chapter 2: Benthic subtidal ecology

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Glossary

Term	Meaning
Annelida	A large phylum that comprises the segmented worms, which include earthworms, lugworms, ragworms, and leeches.
Arthropoda	Phylum with 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.
Cumulative Effects	Changes to the environment caused by a combination of present and future projects, plans or activities.
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.
Drop-down Video	A survey method in which imagery of habitat is collected, used predominantly to survey marine environments.
Echinoderm	A marine invertebrate of the phylum Echinodermata, such as a starfish, sea urchin, or sea cucumber.
Epibenthic	Benthic invertebrates living on the surface of the seabed.
Epifauna	Organisms living on the surface of the seabed.
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 specialized filtering structure.
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.
Invasive Species	An introduced organism that becomes overpopulated and negatively alters its new environment.
Isle of Man Territorial Sea Committee	A cross-governmental committee which was set up to manage the Isle of Man's interests regarding its territorial sea and the resources within it including hydrocarbon, coal and mineral rights, up to the 12 mile limit.
Mollusca	Phylum of invertebrates which have a soft unsegmented body, commonly protected by a calcareous shell.
Morgan Offshore Wind Project: Generation Assets	The Morgan Offshore Wind Project is comprised of both the generation assets and offshore and onshore transmission assets and associated activities.
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	The transmission assets for the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm. This includes the Offshore Substation Platforms (OSPs), interconnector cables, Morgan offshore booster station, offshore export cables, landfall site, onshore export cables, onshore substations, 400kV grid connection cables and associated grid connection infrastructure such as circuit breaker infrastructure (as defined in the Morgan and Morecambe Offshore Wind Farms: Transmission Assets PEIR).
Polychaete	A class of segmented worms often known as bristleworms.

Term	Meaning
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.
Special Area of Conservation (SAC)	Special Areas of Conservation (SACs) are areas designated under the European Union (EU) Habitat's Directive to help conserve certain plant and animal species listed in the Directive. Article 3 of the Habitats Directive requires the establishment of a European network of important high-quality conservation sites that will make a significant contribution to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended). The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds).
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.
Tidal Excursion	The horizontal distance over which a water particle may move during one cycle of flood and ebb.

Acronyms

Acronym	Description
AC	Alternating Current
AL	Action Level
BAP	Biodiversity Action Plan
BNG	Biodiversity Net Gain
CCS	Carbon Capture and Storage
CEA	Cumulative Effects Assessment
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CMS	Construction Method Statement
CSIP	Cable Specification and Installation Plan
CSQGs	Canadian Environmental Quality Guidelines
DCO	Development Consent Order
DDV	Drop Down Video
Defra	Department for Environment, Food and Rural Affairs
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMP	Environmental Management Plan
EPP	Evidence Plan Process
ERM	Effects Range Low
ERL	Effect Range Median

Acronym	Description
EWG	Expert Working Group
HRA	Habitat Regulations Assessment
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IEF	Important Ecological Feature
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
ISAA	Information to Support an Appropriate Assessment
JNCC	Joint Nature Conservation Committee
LOD	Limit of Detection
MarESA	Marine Evidence based Sensitivity Assessment
MARPOL	The International Convention for the Prevention of Pollution from Ships
MCA	Maritime and Coastguard Agency
MCZ	Marine Conservation Zone
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MNCR	Marine Nature Conservation Review
MNR	Marine Nature Reserve
MPCP	Marine Pollution Contingency Plan
MSFD	Marine Strategy Framework Directive
NBN	National Biodiversity Network
NPS	National Policy Statement
NRW	Natural Resources Wales
NSIP	Nationally Significant Infrastructure Project
OESEA	Offshore Energy Strategic Environmental Assessment
OSP	Offshore Substation Platform
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
OWES	Offshore Wind Environmental Standards
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PEIR	Preliminary Environmental Information Report
PEL	Probable Effect Level
SAC	Special Area of Conservation
SACFOR	Superabundant, Abundant, Common, Frequent, Occasional, Rare

Acronym	Description
SNCB	Statutory Nature Conservation Body
SPM	Suspended Particulate Matter
SSC	Suspended Sediment Concentration
SSSI	Site of Special Scientific Interest
TEL	Threshold Effect Level
UK	United Kingdom
UXO	Unexploded Ordnance
ZoI	Zone Of Influence

Units

Unit	Description
%	Percentage
mm	Millimetres
cm	Centimetres
m	Metres
km	Kilometres
nm	Nautical miles
m^2	Square metres
km^2	Square kilometres
m^3	Cubed metres
m^3/d/m	Cubic metres transported per day per metre width of transport path (i.e. perpendicular to direction of transport)
m/s	Metres per second
cm/s	Centimetres per second
m/h	Metres per hour
mg/l	Milligrams per litre
Kg	Kilograms
Kv	Kilovolts
MW	Megawatt
GWh	Gigawatt hour
mG	Milligauss
mV/cm	Millivolt per centimetre
µT	Microtesla
mT	Millitesla
^{o}	Degrees
^{o}C	Degrees centigrade

2 Benthic subtidal ecology

2.1 Introduction

2.1.1 Overview

2.1.1.1 This chapter of the Environmental Statement presents the assessment of the potential impact of the Morgan Offshore Wind Project Generation Assets (hereafter referred to as the Morgan Generation Assets) on benthic subtidal ecology. Specifically, this chapter considers the potential impact of the Morgan Generation Assets seaward of Mean High Water Springs (MHWS) during the construction, operations and maintenance, and decommissioning phases.

2.1.1.2 The assessment presented is informed by the following technical chapters:

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

2.1.1.3 This chapter also draws upon information contained within:

- Volume 4, Annex 1.1: Physical processes technical report of the Environmental Statement
- Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement.

2.1.1.4 In particular, this Environmental Statement chapter:

- Presents the existing environmental baseline established from desk studies, site-specific surveys and consultation
- Identifies any assumptions and limitations encountered in compiling the environmental information
- Presents the potential environmental effects on benthic subtidal ecology arising from the Morgan Generation Assets, based on the information gathered and the analysis and assessments undertaken

2.1.1.5 Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects of the Morgan Generation Assets on benthic subtidal ecology.

2.2 Legislative and policy context

2.2.1 Legislation

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

Marine and Coastal Access Act 2009

2.2.1.2 Parts three and four 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.

Habitats Regulations

2.2.1.4 The Conservation of Habitats and Species Regulations 2017 (as amended) and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) (collectively known as the 'Habitats 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
- Sites of Community Importance
- Ramsar sites[1].

2.2.1.5 These designated sites have been given full consideration in Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement and are given further consideration within section 2.5.6 of this chapter. Additionally the potential impacts of the Morgan Generation Assets on all habitats, species and sites protected under the Habitats Regulations are assessed in the HRA Stage 1 Screening Report (Document Reference E1.4) and HRA Stage 2 Information to support the Appropriate Assessment (ISAA) SAC assessments (Document Reference E1.2).

Environment Act 2021

2.2.1.6 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) in respect of nationally significant infrastructure projects (NSIPs) and amends the Planning Act 2008. These provisions are not yet in force. The provisions include the requirement for the production of BNG statements for applications for development consent under the Planning Act. In response to the recent consultation on the requirements of the Environment Act 2021, the Government has stated that it intends to produce a draft BNG statement and intends to consult with the industry on this (Department for Environment, Food and Rural Affairs (Defra), 2022). The stated intention is for the requirements of the Environment Act 2021 in relation to biodiversity to be implemented no later than 2025, which will temporally overlap with the ongoing development of the Morgan Generation Assets and will require further consideration.

2.2.1.7 The Biodiversity Benefit Statement (Document Reference J18) outlines the approach of the Morgan Generation Assets to biodiversity enhancement.

The Marine Strategy Framework Directive

2.2.1.8 The Marine Strategy Framework Directive (MSFD) aims to protect more effectively the marine environment across Europe. The European Union adopted the MSFD in July 2008. The MSFD is transposed for the whole of the UK by the Marine Strategy Regulations 2010, providing a UK-wide framework for meeting the requirements of the

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[1] As a matter of policy, in the UK, Ramsar sites are given the same protection as sites covered by the Habitats Regulations (Department for Energy Security & Net Zero, 2023a).

Directive. It requires Member States to take measures to achieve or maintain Good Environmental Status (GES). Achieving GES is about protecting the marine environment, preventing its deterioration and restoring it where practical, while allowing sustainable use of marine resources. GES is described in relation to eleven descriptors which help to define the state of the marine environment, these cover both environmental indicators and anthropogenic pressure.

Table 2.1: Summary of the MSFD's high level descriptors of GES relevant to benthic subtidal and intertidal ecology and consideration in the Morgan Generation Assets.

MSFD Descriptor relevant to benthic subtidal and intertidal ecology	How and where considered in the Environmental Statement
Descriptor 1: Biological diversity: Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.	The potential effects on biological diversity has been described and considered within the assessment for the Morgan Generation Assets both alone (see section 2.9) and cumulatively with other projects (see section 2.11). A detailed baseline assessment which describes the distribution of benthic habitats and species in the study area has been undertaken in Volume 2, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement, and a summary presented in section 2.5.
Descriptor 2: Non-indigenous species: Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems.	The potential effects of non-indigenous species has been described and considered within the assessment for the Morgan Generation Assets both alone (section 2.9.7) and cumulatively with other projects (see section 2.11.6).
Descriptor 4: Elements of marine food webs: All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long term abundance of the species and the retention of their full reproductive capacity.	The potential effects on benthic (i.e. prey) species is presented in section 2.9 and implications on the wider marine food webs is assessed accordingly in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement and Volume 2, Chapter 4: Marine Mammals of the Environmental Statement.
Descriptor 6: Sea floor integrity: Seafloor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.	The potential effects of temporary and long term habitat loss/disturbance and introduction of new habitat on benthic ecosystems and associated benthic species have been considered within sections 2.9.2, 2.9.5 and 2.9.7 respectively. Significant effects in EIA terms are not predicted.
Descriptor 7: Hydrographical conditions: Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.	The potential effects of the Morgan Generation Assets on the hydrographical conditions within the Morgan benthic subtidal ecology study area has been described and considered within the assessment for the Morgan Generation Assets both alone (see section 2.9.9) and cumulatively with other projects (see section 2.11.8).
Descriptor 8: Contaminants: Concentrations of contaminants are at levels not giving rise to pollution effects.	The potential effects of contaminants on benthic subtidal ecology receptors from the Morgan Generation Assets alone has been assessed in section 2.9.4.
Descriptor 10: Marine litter: Properties and quantities of marine litter do not cause harm to the coastal and marine environment.	An Offshore EMP will be produced and implemented for the Morgan Generation Assets (see section 2.7.1.2). The Offshore EMP will also outline any procedures to be implemented during the operations and maintenance phase. A Decommissioning Plan will be developed and implemented during the decommissioning phase. No offshore works may commence until a written decommissioning programme is approved by the Secretary

MSFD Descriptor relevant to benthic subtidal and intertidal ecology	How and where considered in the Environmental Statement
	of State for the Department for Energy Security and Net Zero.

2.2.2 Planning policy context

2.2.2.1 The Morgan Generation Assets will be located in English offshore waters (beyond 12 nm from the English coast). As set out in Volume 1, Chapter 1: Introduction of the Environmental Statement. As the Morgan Generation Assets is an offshore generating station with a capacity of greater than 100 MW located in English waters, it is a NSIP as defined by Section 15(3) of the Planning Act 2008 (as amended) (the 2008 Act). As such, there is a requirement to submit an application for a Development Consent Order (DCO) to the Planning Inspectorate to be decided by the Secretary of State for the Department for Energy Security and Net Zero.

2.2.3 National Policy Statements

2.2.3.1 There are currently six energy National Policy Statements (NPSs), two of which contain policy relevant to offshore wind development and the Morgan Generation 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).

2.2.3.2 NPS EN-1 and NPS EN-3 include guidance on what matters are to be considered in the assessment. These are summarised in Table 2.2. NPS EN-1 and NPS EN-3 also highlight a number of factors relating to the determination of an application and in relation to mitigation. These are summarised in Table 2.3:.

Table 2.2: Summary of the NPS EN-1 and NPS EN-3 provisions relevant to benthic subtidal ecology.

Summary of NPS EN-3 and EN-1 provision	How and where considered in the Environmental Statement
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 Environmental Impact Assessment (EIA) Regulations. (EN-1 paragraph 4.3.10)	The scoping process enabled the Morgan Generation Assets to deliver environmental information proportionate to the infrastructure. This is demonstrated in this chapter in regard to the justification of the topics scoped out (section 2.4.2 and Table 2.7) as this demonstrates a proportionate approach.
Where the development is subject to EIA the applicant should ensure that the Environmental Statement 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	The Morgan Generation Assets will aim to conserve habitats through a number of measures adopted to reduce the impact of the Morgan Generation Assets (section 2.7.1.2). Furthermore, section 2.5.6 evaluates relevant designated sites in the regional benthic subtidal ecology study area and the rationale for which sites have been taken forward for assessment in section 2.9. The impact of the Morgan Generation Assets on all European sites with relevant benthic habitats protected under the Habitats Regulations is assessed in the HRA Stage 1 Screening Report (Document Reference E1.4) and the HRA Stage 2 ISAA - SAC assessments (Document Reference E1.2).

Summary of NPS EN-3 and EN-1 provision	How and where considered in the Environmental Statement
conservation of biodiversity, including irreplaceable habitats. (EN-1 paragraph 5.4.17)	
The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests. (NPS EN-1 paragraph 5.4.19)	The Morgan Generation Assets will aim to conserve habitats through a number of measures adopted as part of the Morgan Generation Assets to reduce the magnitude of impacts (see section 2.7.1.2). The Biodiversity Benefit Statement (Document Reference J18) outlines the approach of the Morgan Generation Assets to biodiversity enhancement.
The design process should embed opportunities for nature inclusive design. Energy infrastructure projects have the potential to deliver significant benefits and enhancements beyond Biodiversity Net Gain, which result in wider environmental gains. The scope of potential gains will be dependent on the type, scale, and location of each project. (NPS EN-1 paragraph 5.4.21)	The Biodiversity Benefit Statement (Document Reference J18) outlines the approach of the Morgan Generation Assets to biodiversity enhancement.
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 Marine Conservation Zone (MCZs), Habitat Regulations Assessment (HRA) Sites including Special Areas of Conservation and Special Protection Areas with marine features, Ramsar Sites, Sites of Community Importance and Sites of Special Scientific Interest (SSSIs) with marine features. (EN-1 paragraph 5.6.13)	All relevant designated sites within the Morgan benthic subtidal ecology study area (i.e. SACs, MCZs, SSSIs, Ramsar sites and Marine Nature Reserves (MNR)) with relevant benthic features have been identified within Volume 4, Annex 2.1: Benthic ecology technical report of the Environmental Statement. The designated sites, and their relevant qualifying benthic features, that could be affected by the construction, operations and maintenance, and decommissioning of the Morgan Generation Assets (i.e. that fall within the potential ZoI of the Morgan Generation Assets), are identified in section 2.5.6. As a result of this process the qualifying features of two MCZs have been considered in this assessment, and the relevant MCZs are identified in section 2.5.6 and assessed throughout section 2.9. Additionally an MCZ Screening Assessment (Document Reference: E2) was undertaken to determine if a full MCZ assessment would be required. The MCZ Screening Assessment concluded that the Morgan Generation Assets is unlikely to have the potential to affect the interest features of any MCZ directly or indirectly.
The applicant 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	The Maximum Design Scenario (MDS) represents the parameters that make up the realistic worst case scenario. The worst case that could potentially be built out will be selected on a topic-by-topic and impact-by-impact basis and assessed, for benthic subtidal ecology it has been presented in section 2.7.1 and Table 2.27. Best practice during construction and maintenance will be set out in the Offshore Construction Method Statement (CMS) and the Environmental Management Plan (EMP) (Table 2.17). Following the completion of most activities sedimentary habitats will recover naturally (section 2.9.2 and 2.9.3) and measures have been adopted for the Morgan Generation Assets to avoid direct impacts on sensitive habitats where recovery would be limited (section 2.7.1.2). The Biodiversity Benefit Statement (Document Reference J18) outlines the approach of the Morgan Generation Assets to biodiversity enhancement. The Morgan Generation Assets will aim to conserve habitats through a number of measures adopted to reduce the impact of the Morgan Generation Assets (section 2.7.1.2). Mitigation was considered throughout section 2.9 and 2.11 however no additional mitigation has been considered relevant based on the

Summary of NPS EN-3 and EN-1 provision	How and where considered in the Environmental Statement
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. (EN-1 paragraph 5.4.35)	conclusions reached for benthic subtidal ecology beyond the measures adopted as part of the Morgan Generation Assets in Table 2.17.
The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests. (EN-1 paragraph 5.4.19)	The Morgan Generation Assets will aim to conserve habitats through a number of measures adopted to reduce the impact of Morgan Generation Assets (section 2.7.1.2).
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. (NPS EN-3 paragraphs 2.8.42-43)	All designated sites with relevant benthic ecology features which have the potential to be impacted by the Morgan Generation Assets as well as protected habitats and species within the benthic subtidal and intertidal ecology study area have been identified and considered in the assessment where relevant in sections 2.5.6. The HRA Stage 1 Screening report (Document Reference E1.4) identifies direct or indirect effects on sites which could be affected, and those sites have been assessed in the Information to Support Appropriate Assessment (ISAA) (Document Reference E1.1, E1.2, E1.3). The ISAA concludes that there will be no adverse effect on integrity of any European site as a result of the Mona Offshore Wind Project alone or in-combination with other projects. The MCZ screening report (Document Reference E4) considers the potential for the Morgan Generation Assets to directly or indirectly affect the interest features of any MCZ. The assessments conclude that there is no significant risk of the Morgan Generation Assets hindering the achievement of the conservation objectives stated for any MCZ and therefore a Stage 1 MCZ assessment is not required for any MCZ for the Morgan Generation Assets.
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 (previously referred to as Nature Based Design Standards) to accelerate deployment whilst enhancing the marine environment. Offshore Wind Environmental Standards (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.	The project is aware of the requirements in NPS EN-3 to apply the guidance on Environmental Standards once the final guidance is issued. The project will review the guidance once available and determine how the project complies with the guidance, and where, if relevant, the project departs from them.

Summary of NPS EN-3 and EN-1 provision	How and where considered in the Environmental Statement
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 and support its targets 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. (EN-3 paragraphs 2.8.80-82)	
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 (EN-3 Section 2.8, paragraph 2.8.103)	Scour protection as a measure will be adopted as part of the project as detailed in Table 2.17 and defined in Volume 1, Chapter 3: Project description of the Environmental Statement. Development and adherence to a Construction Method Statement will include details of scour protection management to be used around offshore structures and foundations to reduce scour. The scour protection measures will be subject to engineering design to ensure they minimise as much as practical the occurrence of scour and therefore any impacts would relate only to residual/secondary scour which would be very localised and of negligible magnitude, as discussed in section 2.9.9.
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 export cable routes and installation/maintenance methods, including predicted loss of habitat due to predicted scour and scour 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	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 2.16). The effect of these impacts on the habitats within the Morgan Array Area has then been assessed regarding the project alone throughout section 2.7.1.2 and cumulatively with other relevant projects in the region in section 2.11. A stand-alone DCO application is being sought for the transmission assets required to enable the export of electricity from the Morgan Generation Assets, which will consider the impacts on benthic ecology associated with the construction, operations and maintenance, and decommissioning of the export cables. Therefore the offshore export cable corridor for the Morgan Transmission Assets to accompany the Morgan Generation Assets has not been included in this Environmental Statement. The Transmission Assets have however been considered as part of the Cumulative Effects Assessment (CEA) in section 2.11. 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 2.9.2).

Summary of NPS EN-3 and EN-1 provision	How and where considered in the Environmental Statement
• Potential for invasive/non-native species (INNS) introduction. (EN-3 paragraph 2.8.116)	

Table 2.3: Summary of NPS EN-1 and NPS EN-3 policy on decision making relevant to benthic subtidal ecology.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
NPS EN-1	
The aim is to halt overall biodiversity loss, support healthy well-functioning ecosystems and establish coherent ecological networks, with more and better places for nature for the benefit of wildlife and people. This aim needs to be viewed in the context of the challenge presented by climate change. Healthy, naturally functioning ecosystems and coherent ecological networks will be more resilient and adaptable to climate change effects. Failure to address this challenge will result in significant adverse impact on biodiversity and the ecosystem services it provides. (EN-1 paragraph 5.4.2)	The conservation status of habitats and species is considered throughout this assessment and measures have been adopted to ensure impacts are reduced (section 2.7.1.2). The future impact of climate change on the habitats in the east Irish Sea has been considered in section 2.5.8.
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. (EN-1 paragraph 5.4.42)	Mitigation is considered where the significance of an impact however no impacts were found to have a significant effect in EIA terms (section 2.9) therefore no additional mitigation measures have been considered for the Morgan Generation Assets beyond those measures adopted as part of the project; see section 2.7.1.2.
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. (EN-1 paragraph 5.4.48)	As part of this chapter the process of identifying designated sites has been undertaken for the Morgan benthic subtidal ecology study area (section 2.5.6). This was done to ensure all habitats, features and species of conservation importance were considered, where relevant, in this assessment. Species, habitats and sites protected under the Habitats Regulations are also assessed as part of HRA Stage 1 Screening report (Document Reference E1.4) and the HRA Stage 2 ISAA (Documents References E1.1, E1.2 and E1.3).
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. (NPS EN-1 paragraph 5.4.43)	An assessment of significance was undertaken in sections 2.9 and 2.11, 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 Morgan Generation Assets in section 2.7.1.2.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
NPS EN-3	
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. (EN-3 paragraph 2.8.307)	The effect of impacts related to the design of the Morgan Generation Assets have been assessed in section 2.9. This included the consideration of the sensitivity of the relevant subtidal habitats and the consideration of mitigation where necessary. An evidence plan has been set up with the statutory nature conservation bodies (SNCBs) and other consultees to consult on the project 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.

2.2.4 North West Inshore and North West Offshore Coast Marine Plans

2.2.4.1 The assessment of potential changes to benthic subtidal ecology has also been made with consideration to the specific policies set out in the North West Inshore and North West Offshore Coast Marine Plans (MMO, 2021). Key provisions are set out in Table 2.4 along with details as to how these have been addressed within the assessment.

Table 2.4: North West Inshore and North West Offshore Coast Marine Plan policies of relevance to benthic subtidal ecology.

Policy	Key provisions	How and where considered in the Environmental Statement
NW-SCP-1	Proposals within or relatively close to nationally designated areas should have regard to the specific statutory purposes of the designated area. Great weight should be given to conserving and enhancing landscape and scenic beauty in National Parks and Areas of Outstanding Natural Beauty.	As part of this chapter (as well as Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement), designated sites within the Morgan benthic subtidal ecology study area have been identified (section 2.5.6). This was done to ensure all habitats, features and species of conservation importance were considered, where relevant, in this assessment.
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.	As part of this chapter, designated sites within the Morgan benthic subtidal ecology study area have been identified (section 2.5.6). This was done to ensure all habitats, features and species of conservation importance were considered, where relevant, in this assessment.
NW-BIO-1	NW-BIO-1 encourages and supports proposals that enhance the distribution of priority habitats and priority species.	The Morgan Generation Assets will seek to enhance biodiversity. The Biodiversity Benefit Statement (Document Reference J18) outlines the approach of the Morgan Generation Assets to biodiversity enhancement. The Morgan Generation Assets will aim to conserve habitat through a number of measures adopted to reduce the impact of the Morgan Generation Assets (section 2.7.1.2).

Policy	Key provisions	How and where considered in the Environmental Statement
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.	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 is undertaken for each impact.
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.	Section 2.7.1.2 considers the magnitude, sensitivity and significance of the impacts associated with the Morgan Generation Assets on the relevant subtidal important ecological features (IEF). Additionally considering mitigation where impacts were found to be significant. As a result the Morgan Generation Assets seeks to conserve the function and services provided by coastal habitats
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.	The implementation of an EMP as part of the measures adopted by the Morgan Generation Assets (section 2.7.1.2 and Table 2.17) will manage and reduce the risk of introduction or spread of invasive species.
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 2.11. This section includes the consideration of mitigation where the significance is found to be moderate or major.

2.3 Consultation

2.3.1 Evidence plan

2.3.1.0 A summary of the key issues raised during consultation activities undertaken to date specific to benthic subtidal ecology is presented in Table 2.5 below, together with how these issues have been considered in the production of this Environmental Statement chapter.

2.3.1.1 The purpose of the Evidence Plan Process (EPP) is to agree the information the Morgan Generation Assets needs to supply to the Secretary of State, as part of a DCO application for the Morgan Generation Assets. The EPP seeks to ensure engagement with the relevant aspects of the HRA and EIA throughout the pre-application phase. The development and monitoring of the EPP and its subsequent progress is being undertaken by the Steering Group. The Steering Group comprises of the Planning Inspectorate, the Applicant, Natural England, Natural Resources Wales (NRW), Joint Nature Conservation Committee (JNCC), the Marine Management Organisation (MMO) and the Isle of Man Government as the key regulators and SNCBs. To inform the EIA and HRA process during the pre-application stage of the Morgan Generation Assets, EWGs were also set up to discuss and agree topic specific issues with the relevant stakeholders.

Table 2.5: Summary of key consultation issues raised during consultation activities undertaken for the Morgan Generation Assets relevant to benthic subtidal ecology.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
February 2022	Natural England, MMO, JNCC, Environment Agency, NRW, Cefas and The Wildlife Trust - First Benthic Ecology, Fish and Shellfish and Physical Process EWG meeting 1	Natural England and JNCC have been working on best practice guidance which will be published on a Natural England SharePoint site next week to inform external stakeholders (Natural England, 2022). The Applicants should review this guidance.	The draft guidance has been reviewed and the evidence plan template has taken it into account.
March 2022	JNCC - Benthic Ecology, Fish and Shellfish and Physical Processes EWG meeting 1 Response	JNCC noted the presence and initial analysis of seapens and burrowing megafauna communities within the array area and welcomed the opportunity to review the assessment of this feature. JNCC provided information which may prove useful in further analysis.	The presence of this feature was assessed following the site specific surveys, a summary of these results is presented in Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement. The results concluded that the habitats within the Morgan Array Area had only a negligible resemblance to the seapens and burrowing megafauna habitat however this habitat has been included in the assessment (sections 2.9 and 2.11) as an IEF (Table 2.11) on a precautionary basis.
July 2022	Natural England – Scoping Opinion	Natural England advised that secondary scour protection impacts on seabed habitats are scoped in until further detailed methods and impacts can be assessed, and justification provided to scope out of the Environmental Statement.	Secondary scour was scoped out of Volume 2, Chapter 1: Physical processes of the Environmental Statement and an assessment is therefore not required in this chapter. There is a commitment to provide scour protection and the effectiveness in limiting residual or secondary scour is subject to site specific detailed design.
		Natural England did not agree that there was sufficient evidence to scope out: • EMF • The release of sediment-bound contaminants. They were unclear whether impacts from temperature changes due to heating from cables on benthic communities has been considered and whether it is scoped into or out of the project assessment.	All impact pathways have been scoped into this assessment. The effects of EMF are assessed in section 2.9.10, the release of sediment bound contaminants is assessed in section 2.9.4, and heat effects is assessed in section 2.9.11.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		The following types of projects should be included in the cumulative assessment: existing completed projects; approved but uncompleted projects; ongoing activities; plans or projects for which an application has been made and which are under consideration by the consenting authorities; and plans and projects which are reasonably foreseeable (i.e. projects for which an application has not yet been submitted, but which are likely to progress before completion of the development and for which sufficient information is available to assess the likelihood of cumulative and in-combination effects).	A cumulative assessment has been undertaken and is presented in section 2.11. The methodology for determining which projects have been included is presented in section 2.10.
		Natural England advised that the potential impact of the proposal upon features of nature conservation interest and opportunities for habitat creation/enhancement should have been included within this assessment in accordance with appropriate guidance on such matters. The Environmental Statement should thoroughly assess the potential for the proposal to affect designated sites.	The impact of the Morgan Generation Assets on designated sites and their relevant protected features has been considered throughout this assessment. Section 2.5.6 explains which sites and features (i.e. species and habitats) were scoped into this assessment. Opportunities for habitat creation have been considered in the introductions of artificial structures impact (section 2.9.6).
		Highlighted that mitigation for non-designated but important conservation assets should be further considered and set out in the Environmental Statement.	Mitigation had been considered throughout this assessment in regard to habitats of conservation importance not in designated sites. In the absence of significant effects, no mitigation is deemed to be necessary, and no mitigation has therefore been proposed.
		Natural England advised that seabed preparation activities and impacts to benthic ecology will need to be considered.	The MDS (Table 2.16) sets out the potential temporary habitat disturbance/loss which may result from the seabed preparation proposed for the Morgan Generation Assets. The effects have also been assessed in other relevant impacts such as increased suspended sediments and re-mobilisation of sediment bound contaminants (sections 2.9.3 and 2.9.4).

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		Natural England requested detail on how impacts from increased suspended sediments concentration (SSC) and associated deposition during decommissioning was to be assessed.	Modelling was undertaken for the extent of this potential impact in the construction phase when the greatest levels of SSC were expected to occur. The assessment assumes that following decommissioning, increases in SSC and potential impacts would be of lesser magnitude than both the construction phase and the operations and maintenance phase with cables and scour and cable protection remaining *in situ*. For further information on modelling see Volume 4, Annex 1.1: Physical processes technical report of the Environmental Statement.
		Natural England noted that the report states 'permanent habitat loss may occur under any infrastructure that is not decommissioned'; however it does not go on to fully justify that all infrastructure will be removed in decommissioning phase as this level of detail is currently unknown. In the absence of this, we would consider there could be permeant habitat loss from Morgan Offshore Windfarm.	The magnitude of permanent habitat loss (the result of infrastructure which will not be removed during decommissioning) has been set out in the MDS (Table 2.16) and assessed in section 2.9.5.
		Further consideration of how the removal of foundations and potential loss of species/habitats will need to be assessed in order to determine the significance of effect.	The effect of the removal of hard substrates on the relevant habitats has been assessed in section 2.9.8.
		Natural England stated that it was not clear in the benthic section how any changes to hydrodynamics and impacts of these on benthic habitats will be assessed e.g. changes in water flow, wave and tide climate.	The effect of the changes in physical processes on the relevant habitats has been assessed in section 2.9.9. These processes were also modelled as part of the physical processes technical report (see Volume 4, Annex 1.1: Physical processes technical report of the Environmental Statement).
		Natural England advised that the method of classification of habitats is clearly set out (e.g. European Nature Information System/JNCC habitat code).	The method for the classification of habitat is described in detail in Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement. The habitats were classified using the JNCC Marine Habitat Classification for Britain and Ireland system.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
	MMO – Scoping Opinion	The MMO was content that the approach provided by the applicant is sufficient to fully identify and assess potential impacts. The approach includes an assessment of the current information available and a commitment to undertake site specific surveys to collect relevant information on the benthic environment within the scoping area (sampled in 2021) and Zone of Influence (ZoI) (sampled in 2022).	Noted and this chapter has been updated with the 2022 data collected within the ZoI for the final Environmental Statement following the completion of the data analysis presented in full in Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement.
		The impacts considered within the document appear appropriate and include those relevant to benthic ecology.	Noted and the full list of impacts assessed within this chapter is detailed in Table 2.16.
		The MMO advised that EMF is considered and discussed further in the EIA and is evidenced with the latest available literature.	The impact of EMF has been assessed in section 2.9.10 and has included consideration of the provided sources.
		The MMO recommended that impacts on the wider benthic assemblage within the Morgan Generation Assets are also considered, particularly when it comes to developing the monitoring plan for the site so that the impact of the Morgan Generation Assets on the benthic assemblage within the scoping area and ZoI can be suitably evidenced.	The wider benthic community within the Morgan Array Area ZoI has been characterised (see Volume 4, Annex 1.1: Benthic subtidal ecology technical report of the Environmental Statement for details on how) and IEFs have been identified (Table 2.11). In the absence of significant effects, no monitoring has been proposed for the Morgan Generation Assets.
		The MMO highlighted that infrastructure should be positioned to avoid impacts on any features of conservation importance identified during baseline or pre-construction surveys.	Features of conservation importance were not recorded within the Morgan Array Area and so will not be directly affected by the infrastructure.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		The MMO was content that the following impacts can be scoped out of further assessment at EIA stage: • Accidental pollution during construction, operations and maintenance and decommissioning phases • Underwater noise from wind turbine operation during operations and maintenance phase • Underwater noise from vessels during all phases • Impacts from the release of sediment-bound contaminants.	Noted however the impact of sediment-bound contaminants was assessed based on feedback from other consultees.
		The MMO was content with the proposal for cumulative impacts and in-combination impacts.	Noted.
	The Planning Inspectorate – Scoping Opinion	The Scoping Report proposed to scope out accidental pollution at all phases of the project. The Inspectorate agreed that such effects can be scoped out of the assessment. The Environmental Statement should provide details of the proposed mitigation measures to be included in the Environmental Management Plan and its constituent Marine Pollution Contingency Plan (MPCP). The Environmental Statement should also explain how such measures will be secured.	Accidental pollution has been scoped out of this report. Details of the proposed mitigation measures will be included in the Offshore EMP and MPCP will be included in the final Environmental Statement.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		The Planning Inspectorate agreed that: • an assessment of the potential risk of INNS introduction and spread during the operations and maintenance phase • an assessment should consider the colonisation of hard structures in the construction and decommissioning phases • an assessment should consider that there is potential for physical processes to change during the construction phase • long term habitat loss during the decommissioning phase can be scoped out.	• An assessment of the potential risks if INNS introduction and spread has been completed in section 2.9.7 • An assessment considering the colonisation of hard structures has been completed in section 2.9.5.18 • An assessment of the effects associated with the potential for physical processes change has been completed in section 2.9.9 • An assessment of long term habitat loss in the decommissioning phase has been scoped in based on feedback from other consultees.
		The Environmental Statement 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 duration of an impact and the potential recovery time in relation to that impact has been assessed within each impact. This has been taken into account when assessing the magnitude of an impact and the sensitivity of the receptors, both of which have then been used to determine if an impact significantly affects the benthic environment.
		The Environmental Statement should assess impacts on the wider benthic assemblage where significant effects are likely to occur.	The wider benthic environment within the benthic subtidal ecology study area has been described within section 2.4 and characterised as IEFs in Table 2.11. All of which have been assessed where relevant throughout this assessment (section 2.8.1.3).
		The Environmental Statement should determine if there would be any temperature changes as a result of cable presence and assess any impacts on benthic communities where they are likely to occur.	An assessment of the potential impact of the release of heat from subsea cables within the Morgan Array Area is presented in section 2.9.11.
		Drilling arisings disposal site. The Environmental Statement should have identified the likely site for disposal of drilling arisings and include an assessment of effects from these activities.	The disposal of drilling has been assumed to occur within the Morgan Array Area and the effects of drilling on SSC have been assessed in section 2.9.3.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		The Inspectorate considered 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 four years, during this time, changes in physical processes may occur. Therefore, the Inspectorate does not agree to scope this matter out. The Environmental Statement should assess impacts to physical processes during construction and decommissioning where significant effects are likely to occur.	The infrastructure is not fully installed in the construction phase therefore the impact in relation to the effect of the infrastructure installed in the construction phase has been assessed following its completion in the operations and maintenance phase. Additionally no infrastructure is left in the water column following decommissioning therefore no assessment has been conducted for this phase of the project.
March 2023	Cefas –Benthic Ecology, Fish and Shellfish and Physical Processes EWG meeting 3	Cefas queried where the grab imagery data and eDNA will be shown within the ES.	All grab sample analysis is presented in Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement. The full data is available on request. An overview of the eDNA analysis is included for reference in an appendix to Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement but is not used to inform the assessment for Environmental Statement. The main characterisation comes from grab and Drop Down Video (DDV).

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
June 2023	Isle of Man Government – Section 42 Responses	The Isle of Man Government noted for the Isle of Man projects listed below; • Douglas Harbour, Isle of Man • Castletown Bay, Isle of Man – not aware of this as a current operation • Maintenance Dredging Peel Harbour Isle of Man – please check quantities (400,000 m^3 annually is not considered correct), and disposal at sea is not currently a viable option. Has Isle of Man Government (Department of Infrastructure) been consulted on the details and assumptions related to the above projects? It is not clear whether these projects are active, or that the correct quantities or assumptions about waste disposal sites have been made. Recommend clarification with Department of Infrastructure.	A request for information was sent out to the Isle of Man Government on these projects, the response has led to Castletown Bay being removed from the CEA whereas Douglas Harbour and Peel Harbour dredge projects have been confirmed as active and have been kept in (see Table 2.26).
		As noted, recommend inclusion of Ørsted Isle of Man windfarm and, under the appropriate heading, Crogga gas exploration/production projects. Has Manx Utilities been consulted over plans for a second electricity interconnector between UK and east coast Isle of Man? Likely within 10 years. And then assessed as appropriate in subsequent analysis?	The Crogga gas exploration/production project has been considered in the CEA process however the drilling phase will be completed before the construction phase of the Morgan Generation Assets commences and therefore only the operation and maintenance phase of the project has been included in the CEA (section 2.11). Manx Utilities were consulted to address this comment and as a result the Manx Interconnector 2 has been included as a Tier 3 project in the CEA (section 2.11).
	MMO – Section 42 Response	The MMO noted that section 7.4.5.12 concludes that no survey stations had anything other than a negligible resemblance to the ‘seapens and burrowing megafauna communities’ habitat. The MMO considered that this sensitive habitat should be scoped in as a receptor and included in the EIA. At very least, the report would require further information as to why these have been scoped out.	In the interest of adopting a precautionary approach and after examining the full dataset regarding the ‘seapens and burrowing megafauna communities’ habitat it has been scoped in for assessment and included as an IEF (Table 2.11).

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		The MMO noted that section 7.4.5.13 concludes that the Biodiversity Action Plan (BAP) habitat 'fragile sponge and anthozoan communities on rocky habitats' is not present within the array area on the basis that its characteristic species were only recorded at very low abundances. The MMO recommended more information should be provided to compare the observed presence of characteristic species, to any quantitative thresholds referenced in the definition of this habitat. If such thresholds are not defined or the available data doesn't allow a comparison to such thresholds, then it is appropriate to be precautionary and assume that this habitat is present in the areas, even where only a low abundance has been observed.	The full assessment of this habitat is presented in Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement. This assessment concluded that in most images taken only a single sponge was identified and therefore these sites could not be classed as representing the fragile sponge and anthozoan communities on rocky habitats community.
		The MMO noted that the magnitude was concluded as 'low' where up to 87 km^2 of seafloor habitat will be disturbed or lost. The MMO recommends that further information is provided to support this conclusion and indicate whether, and to what extent, the impact footprint could be minimised, reduced, or mitigated. Additionally, when discussing disturbance during decommissioning, the MMO recommends stating what (if any) actions they would take if sensitive habitats have formed over areas where cables have been buried.	As a result of project parameters updates which have been made post-PEIR, the area of seabed which may be affected by temporary habitat disturbance/loss has been reduced to 61.42 km^2. The conclusion of a 'low' magnitude has been reached based on the percentage of the Morgan benthic subtidal ecology study that this represents (6.43%) which is small and, as described in section 2.9.2, recovery for all IEFs is likely to occur. The decommissioning of the Morgan Generation Assets will be subject to the policy and legislation in place at the time of decommissioning therefore it is not possible to make commitments regarding what will and will not be removed. The assessments in this chapter consider the MDS which would be for the removal of all artificial substrate and infrastructure.
		The MMO noted that there will be 1.5 km^2 of permanent habitat loss. As this is a large area, the MMO recommend additional information is added as to how this can be minimised, reduced or mitigated.	The amount of permanent habitat loss associated with the Morgan Generation Assets has reduced to 1.25 km^2 due to project parameter refinements post-PEIR. No measures have been adopted to specifically mitigate permanent habitat loss however the application of the MDS process ensures that an assessment of the greatest extent of this potential impact has been considered.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		The MMO noted inconsistencies regarding the presentation of the sediment chemistry analysis.	The sediment chemistry results presented in section 2.5 (as well as in Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement) have been checked and amended to remove these inconsistencies.
		The MMO noted that no benthic ecology monitoring is proposed at this stage. The MMO would expect the effects on benthic ecology receptors to be monitored, to determine whether the predictions of the Environmental Statement are accurate, especially when sensitive features are potentially at risk. Once more additional information is provided regarding 'fragile sponge and anthozoan communities on rocky habitats' the MMO will be able to advise whether monitoring is required following the incorporation of the 2022 site specific surveys.	No significant effects have been concluded as a result of the Morgan Generation Assets alone assessment (section 2.9) therefore no monitoring has been proposed. Additional information and data regarding the 'fragile sponge and anthozoan communities on rocky habitats' has been provided in Volume 4, Annex 2.1: Benthic subtidal ecology study area of the Environmental Statement. A summary of this assessment has been included in section 2.5. In summary, this habitat was not recorded in the Morgan benthic subtidal ecology study area.
		The MMO noted that within parts of the report, it has not been evidenced which aspects of the described benthic ecology baseline come from which sources. All baselines should be labelled and sourced, even where existing data was used either alongside or instead of site-specific survey data. The MMO also recommends that additional information is provided on how the data from the desktop study was used.	All of the information presented in section 2.5 is from the 2021 and 2022 site specific benthic surveys and has been signposted as such. The desktop data was used to determine the expected baseline for the Morgan benthic subtidal ecology study area (as presented in Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement) and compare with what was found in the site specific surveys.
		The MMO highlighted that encrusted growth may be removed from installed structures, however it is unclear whether such measures would be put in place specifically to mitigate the potential spread of any INNS that may colonise the installed structures. The MMO recommends that additional clarification is provided on this point, particularly the reasonings behind removals and potential methodology.	The removal of encrusted growth from infrastructure is not anticipated to occur on a routine basis, but for example it could be required to inspect a weld on the infrastructure or if the growth encroached on the design load factor. Should this be necessary the removal would be undertaken by remotely operated vehicles or divers. Actions to minimise the spread of INNS will be included as part of the Offshore EMP and is likely to include control measures for cleaning and disposal of biofouling from structures during operations and maintenance phase of the Morgan Generation Assets.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		The MMO noted that the CEA should be supported by an assessment of the connectivity between the Morgan Generation Assets and other hard habitats, with consideration for the fact that the larvae of benthic invertebrates can disperse over distances of tens of kilometres to more than a hundred kilometres (Álvarez-Noriega *et al*., 2020). The MMO also recommended that the CEA should consider whether the presence and spatial distribution of installed hard structures increases connectivity between other (natural or artificial) hard habitats in the region, thus potentially acting as 'stepping stones' for the spread of INNS.	All projects included within a 50 km of the Morgan Generation Assets have been included in the CEA. This buffer captures all of the relevant projects within the Morgan CEA benthic subtidal ecology study area. An assessment of the potential cumulative impact of an increased risk of introducing and spreading INNS has been conducted in section 2.9.7.
		The MMO noted the definition of receptor 'sensitivity' differs between this chapter and Volume 1, Chapter 5: EIA methodology of the PEIR. The MMO recommended that the difference between the two tables be made more clear, and that the definition of sensitivity is clarified for both tables.	The definition of sensitivity has been adapted for this chapter to include vulnerability and recoverability as well as considering the value and rarity. This is not relevant for all assessments in the Environmental Statement and therefore it is not included in Volume 1, Chapter 5: EIA methodology of the Environmental Statement.
		The MMO noted the sensitivity of subtidal sand in West of Walney MCZ to the pressure 'Water flow (tidal current) changes (local)' is written as "not sensitive – medium", however the MMO considers this should read as "not sensitive". Please could this be clarified and evidenced.	The sensitivity of the West of Walney MCZ IEFs has been checked and adjusted in section 2.9.9.
	Natural England – Section 42 Responses	It is noted that further surveys were undertaken in summer 2022, but no results are currently included. It would have been beneficial for the survey locations to be included as a figure in the report. Natural England advises that the report should include all current/planned sample stations, even if full results are not yet available.	The results of the 2022 site specific benthic survey have been included in section 2.5 including the locations of the sample stations in Figure 2.2 and Figure 2.3. The results of the site-specific benthic surveys in 2021 and 2022 are described in full in Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		Natural England noted there is no indication of how the geophysical data was used to inform the positioning of the sample stations, if at all, or any indication of the bedforms encountered and how they may have related to the ecology or have been used to create the habitat map. Natural England advised that details of geophysical surveys, and correlation of the geophysical data is included with benthic ecology data to provide confidence in the mapped outputs.	Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement provides the full methodology regarding how the locations of the grab samples were chosen. The locations were refined based on the 2022 geophysical data to ensure all potential habitats were sampled. The bedforms identified by the geophysical surveys have been included in section 2.5.
		Natural England advised that further assessment is required within the Environmental Statement in relation to seabed preparation works including (but not exclusively) boulder clearance and UXO detonation. 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.	Consideration of UXO craters is included in the assessment of temporary habitat disturbance/loss in section 2.9.2. The assessments presented in the section 2.9 have also been checked and adjusted to take in to account the highest sensitivity assigned to a biotope within an IEF. Therefore a precautionary approach has been adopted
		Natural England noted the MDS for sandwave clearance width – inter-array across an impact width is 104 m. These are exceptionally large areas when compared to other offshore windfarm projects. Please refine down this substantial MDS for sandwave clearance in the final application.	The MDS for sandwave clearance has been refined for inter-array cables down from 104 m to 80 m (see Table 2.16 and paragraph 2.9.2.6).

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		The extent and location of sediment disturbance (area, volume) should be provided for affected MPAs/features (e.g. West of Copeland MCZ and West of Walney MCZ). Natural England also queried how will the sediment be retained within designated sites to ensure that the sandbanks will fully recovery i.e. have the same structure and function.	As the West of Walney and West of Copeland MCZ fall outside the Morgan Array Area there will be no direct disturbance of sediment within their boundaries. Indirect impacts from increases in SSC and associated deposition as well as changes in physical processes may affect these MCZs however all the material will remain within the regional sediment cell and therefore it is not likely there will be an impact on the formation of sedimentary features.
		It is very confusing re-labelling Marine Evidence based Sensitivity Assessment (MarESA) resistance as vulnerability and then using a reverse scale (i.e. high resistance = low vulnerability). It makes it very difficult to read across from Table 7.11 to Table 7.12. It also adds an unnecessary step, when the MarESA pressures could just be combined with the conservation value and then used to produce the result in Table 7.12. As it is presented, Table 7.12 does not include all the possible combinations of vulnerability/resistance and recoverability/resilience that are in Table 7.11. Natural England advised that, in future, consistent terminology is used to increase transparency.	Table 2.15 has been amended to use terminology consistent with the EIA approach which has been adopted across the Morgan Generation Assets Environmental Statement. A footnote has been included to highlight that this text has been amended from that used in MarESA.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		Natural England noted the installation of the Morgan Generation Assets infrastructure may lead to up to 9.14% of temporary habitat loss within the Morgan benthic subtidal ecology study area. Natural England advised that more clarity should be provided within this section on what is consider temporary habitat change. In addition, Natural England suggests that a more meaningful measure of temporary habitat loss is presented in terms of how this percentage relates to the different habitats present within the survey area.	A full description of what is included as temporary habitat disturbance/loss can be found in Table 2.16. It is not currently possible to determine where the infrastructure will be placed on the seabed, therefore it is not possible to apportion the impacts on a habitat-by-habitat basis. The subtidal coarse and mixed sediments with diverse benthic communities IEF covers the majority of the Morgan Array Area (82%) and so the majority of impact will be to this IEF and to a lesser extent the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF (18%). As a result it is possible 82% of the temporary habitat disturbance associated with the Morgan Generation Assets will occur within the subtidal coarse and mixed sediments with diverse benthic communities IEF (accounting for 50,366,368 m^2 of disturbance) and 18% may occur in the *Lagis koreni* and other polychaetes IEF (accounting for 11,056,032 m^2 of disturbance). This can only however be an estimate as the exact position of the infrastructure within the Morgan Array Area is not yet known.
		Natural England did not agree that boulder clearance should be considered a temporary disturbance. Boulder clearance will result in a permanent change both at the removal location and to where they are relocate. Natural England advised that boulder removal should be considered a permanent change and consideration given to mitigation measures.	The term boulder clearance refers to the disturbance to the seabed associated with the moving of boulders on the seabed. It is a temporary action with the disturbed sediment settling soon after the boulders are moved. The boulders will be sidecast in the immediate vicinity of the cable route and therefore will not be removed from the system allowing for recovery of habitats.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		Natural England suggested that increased risk of introduction and spread of INNS due to cumulative effects would also occur during the operational phase, as the increase of available hard structures within the wider regional area provides more opportunities for spread of INNS via the 'stepping-stones' that the additional hard structures provide. Natural England would like to see evidence that continued increase in infrastructure of offshore windfarms does not increase risk of spread of INNS, if biosecurity plans are followed. Post construction monitoring could help to confirm this.	The impact of an increased risk of introduction and spread of INNS has been assessed in the operations and maintenance phase of the CEA in section 2.11.6. As outlined in the Offshore in-principle monitoring plan (Document Reference J11), DDV asset integrity surveys of the foundations will likely be undertaken at least every four years during the operation and maintenance phase using a remotely operated vehicle. Any footage available from these surveys will be reviewed by suitably experienced marine ecologists to determine whether the quality would allow for the identification of INNS. If so, the footage would be reviewed by suitably experienced marine ecologists in accordance with the requirements of the INNS Management Plan which will be included in the Offshore EMP (see Table 2.17).
	NRW – Section 42 Responses	NRW wish to raise concerns surrounding the cumulative impacts from the Morgan and Mona array to the regional sediment budget and sediment transport system of the North Wales coast, which could indirectly impact benthic habitats.	As noted in section 2.9.3 any sediment deposition result from the Morgan Generation Assets will occur within the same sediment cell that it was disturbed within. Additionally as noted in section 2.9.9, infrastructure from the Morgan Generation Assets will have an insignificant impact on the sediment transport within these cells.
		There is a significant amount of cable protection proposed for both the Morgan and Mona Array sites which will potentially lead to long term habitat loss and change of seabed substrate and supporting habitat for other receptors (i.e. marine ornithology, benthic ecology) within Welsh waters. NRW strongly advised that cable protection measures are minimised as much as possible for both sites.	From PEIR to Environmental Statement the area of seabed affected by placement of cable protection for the Morgan Generation Assets has reduced from 620,000 m^2 to 510,000 m^2. Section 2.7.1.2 details the commitment to cable burial where possible which will enable the minimum amount of cable protection on the seabed.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		NRW agreed that the SSC plumes arising from the sand wave clearance and cable installation activities at the Morgan Array Area site do not tidally advect over to the Mona Array Area site or impact on any designated features in Welsh Waters. The impact to bedload sediment transport processes and the regional sediment budget should be assessed in-combination (Morgan, Mona and Morecambe Offshore Wind Farm Array sites) and considered in line with other receptor groups, i.e. fish and benthic habitats, as physical processes are a pathway for impacts to other receptor groups.	The structure of the CEA (section 2.10) has been adjusted to ensure the proportionate and clear assessment of the Morgan Generation Assets in combination with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets, Morecambe Offshore Windfarm Generation Assets and Mona Offshore Wind Project.
	North West Wildlife Trust – Section 42 Response	The North West Wildlife Trust was concerned to note that the worse-case cumulative area of seabed disturbance is up to 87,360,220 m^2 of habitat loss/disturbance during the construction phase and that this is underplayed as a small area within the PEIR, and thus of small magnitude for impact assessment.	Project parameter refinements post-PEIR have resulted in a reduction in the area associated with temporary habitat loss to 61,422,400 m^2 which represents 6.43% of the Morgan benthic subtidal ecology study area. This is considered proportionally a small area of disturbance which is likely to recover following construction.
		The North West Wildlife Trust noted up to 50,107,820 m^2 of habitat disturbance associated with the sandwave clearance deposition – this is a huge area and without smaller parameters it is hard to comment.	The area of temporary habitat disturbance attributed to sandwave clearance deposition has reduced to 36,473,840 m^2.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		The PEIR stated that there will be long term habitat creation of up to 1,995,525 m^2 but operations and maintenance phase is only 35 years, which in terms of ecological timelines is not long term. Full consideration of this habitat creation needs to be taken during the decommissioning phase if this is to be phrased as a benefit. The North West Wildlife Trust noted that the new hard substrate will represent a shift in the baseline conditions whilst this will increase biodiversity as noted, full consideration needs to be considered for the change in ecological conditions and the impact of this.	An assessment of the impact of the permanent introduction of artificial structures in the decommissioning phase has been added in section 2.9.6. The assessment of the introduction of artificial structures into the soft sediment dominated Morgan Array Area has been considered in the magnitude and sensitivity sections of this impact (section 2.9.6).
		The North West Wildlife Trust were disappointed that fishing has been considered as part of the baseline and has not been included in the CEA for benthic and subtidal ecology. Fishing is a licensable activity that has the potential to have an adverse impact on the marine environment.	Fishing has not been included in the CEA as is it considered to be part of the regional baseline (i.e. ongoing at the time the benthic surveys were undertaken) and appropriate data is not available regarding the magnitude of the potential impact of fishing on benthic receptors. No meaningful assessment could, therefore, be carried out to incorporate it into the assessments of the EIA and HRA. This is an approach which has been taken across the Environmental Statement.
		The North West Wildlife Trust were concerned that the baseline conditions already represent a degraded state from its potential, given the 'shifting baseline syndrome'. Therefore biodiversity net gain is essential to achieve through development.	When compiling the baseline for the Morgan Array Area and ZoI the most recent desktop data as well as recent site-specific data was used. It has not been possible to determine the historical baseline however consideration regarding the potential for the baseline to shift in the future as a result of impacts such as climate change has been made in section 2.5.8. The Biodiversity Benefit Statement (Document Reference J18) outlines the approach of the Morgan Generation Assets to biodiversity enhancement.
	Ørsted – Section 42 Responses	The ZoI overlaps with Isle of Man Territorial Sea. However, it is stated that there are no potential transboundary impacts.	An assessment of transboundary affects has been conducted in section 2.12 including regarding any potential impact on the Isle of Man territorial sea however it was concluded that there was no impact from the Morgan Generation Assets.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
		There are multiple references to the MaresConnect Tier 3 Project being the only project identified within the CEA with the potential for cumulative impacts with the Morgan General Assets. However, other chapters provide comments on the Isle of Man Offshore Wind Farm, which the Applicant has categorised as Tier 3. Clarification is needed regarding this inconsistency and how the potential for cumulative impacts with the Isle of Man Project have been assessed.	The Isle of Man Offshore Wind project has been included in the CEA (section 2.11) in Tier 2 as a Scoping Report was published in October 2023 for project. This approach has been taken across the Morgan Generation Assets Environmental Statement.
July 2023	JNCC, Natural England, NRW, Isle of Man Government, The Wildlife Trust, MMO and Cefas – Benthic Ecology, Fish and Shellfish and Physical Processes EWG meeting 4	This meeting updated the stakeholders on the proposed actions relating to key issues raised by SNCBs as part of the section 42 consultation process including: • Inconsistencies regarding the presentation of the sediment chemistry analysis • Refinements to the project design • Consideration of UXO crater size and depth • Queries regarding the presence of the seapens and burrowing megafauna community. No comments regarding these matters were raised by the SNCBs during the meeting.	The sediment chemistry results presented in section 2.5 (as well as in Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement) have been checked and amended to remove these inconsistencies. The refinements to the project design have been incorporated into the MDS for relevant impact pathways in Table 2.16 and assessed in section 2.9. An assessment of UXO detonation in presented in paragraph 2.9.2.9. In the interest of adopting a precautionary approach and after examining the full dataset regarding the ‘seapens and burrowing megafauna communities’ habitat it has been scoped in for assessment and included as an IEF (Table 2.11).
December 2023	JNCC, Natural England, NRW, Isle of Man Government, The Wildlife Trust, MMO and Cefas – Benthic Ecology, Fish and Shellfish and Physical Processes EWG meeting 6	This meeting provided detail on the updated baseline for the Morgan Generation Assets benthic subtidal ecology study area following the inclusion of the 2022 site specific survey data. An update was given also regarding the updates made to the benthic ecology assessments post-PEIR to incorporate PDE updates and to respond to the comments raised in the section 42 consultation. No comments regarding this content were raised by the SNCBs during the meeting.	As no comments were raised by the SNCBs during this meeting no further response is required from the Applicant.

2.4 Baseline methodology

2.4.1 Relevant guidance

2.4.1.1 There are a number of guidance documents which have been considered when putting together compiling the baseline for this chapter, and the key documents are described below.

2.4.1.2 The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) guidance on Environmental Considerations for Offshore Wind Farm Development has a primary aim to provide scientific guidance to those involved with the gathering, interpretation and presentation of data within an EIA as part of the consents application process in England (OSPAR, 2008). In this chapter this guidance has informed the sampling strategy and design of the surveys to determine the baseline for the Morgan benthic subtidal ecology study area, as well as the processing of the collected samples.

2.4.1.3 The identification of sensitive and protected benthic habitats is a key feature of this chapter. One of these habitats is Annex I stony reef, these habitats were specifically targeted in subtidal baseline characterisation surveys to determine if it existed within the Morgan benthic subtidal ecology study area (these assessments are presented in full in Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement). To determine if the habitats surveys met the criteria to be classified as Annex I stony reef the 'Identification of the Main Characteristics of Stony Reef Habitats under the Habitats Directive' (Irving, 2009) and 'Refining the criteria for defining areas with a 'low resemblance' to Annex I stony reef' (Golding *et al*., 2020) guidance have been used.

2.4.2 Scope of the assessment

2.4.2.1 The scope of this Environmental Statement has been developed in consultation with relevant statutory and non-statutory consultees as detailed in Table 2.6. The scope of this assessment is to determine if any impacts, whether direct or indirect, could have a significant effect on the habitats which have been identified in the Morgan benthic subtidal ecology study area. This assessment has taken a precautionary and proportionate approach therefore impacts which are highly unlikely to result in a change to the environment have been scoped out.

2.4.2.2 Taking into account the scoping and consultation process, Table 2.6 summarises the potential impacts considered as part of this assessment.

Table 2.6: Potential impacts scoped into this assessment.

Activity	Potential impacts scoped into the assessment
Construction phase	
Site preparation (e.g. sandwave clearance, boulder clearance, etc.)	Temporary habitat loss/disturbance
Foundation installation	
Jack up events	
Anchor placement	
Cable installation	
Cable removal	

Activity	Potential impacts scoped into the assessment
UXO removal	
Site preparation (e.g. sandwave clearance, boulder clearance, etc.)	Increase in SSC and associated deposition
Foundation installation	
Cable installation	
Site preparation (e.g. sandwave clearance, boulder clearance, etc.)	Disturbance/remobilisation of sediment-bound contaminants
Foundation installation	
Cable installation	
Presence of: • Wind turbine and Offshore Substations Platform (OSP) foundations • Wind turbine and OSP scour protection • Cable protection • Cable crossings.	Long term habitat loss
Presence of: • Wind turbine and OSP foundations • Wind turbine and OSP scour protection • Cable protection • Cable crossings.	Introduction of artificial structures
Vessel Movement	Increased risk of introduction and spread of INNS
Presence of: • Wind turbine and OSP foundations • Wind turbine and OSP scour protection • Cable protection • Cable crossings.	
Operations and maintenance phase	
Wind turbine and OSP maintenance	Temporary habitat loss/disturbance
Cable repair and reburial (subtidal)	
Cable repair and reburial	Increase in SSC and associated deposition
Presence of: • Wind turbine and OSP foundations • Wind turbine and OSP scour protection • Cable protection • Cable crossings.	Long term habitat loss
Presence of: • Wind turbine and OSP foundations • Wind turbine and OSP scour protection • Cable protection • Cable crossings.	Introduction of artificial structures
Vessel Movement	Increased risk of introduction and spread of INNS

Activity	Potential impacts scoped into the assessment
Presence of: • Wind turbine and OSP foundations • Wind turbine and OSP scour protection • Cable protection • Cable crossings.	
Presence of: • Wind turbines • OSPs • Cable protection • Scour protection.	Changes in physical processes
Operational cables	EMF from subsea electrical cables
Operational cables	Heat from subsea electrical cables
Decommissioning phase	
Cable removal	Temporary habitat loss/disturbance
Anchor placement	
Jack up event	
Cable removal	Increase in SSC and associated deposition
Foundation removal – suction bucket	
Cable removal	Disturbance/remobilisation of sediment-bound contaminants
Foundation removal – suction bucket	
Presence of: • Wind turbine and OSP scour protection • Cable protection.	Long term habitat loss
Vessel movement	Introduction of artificial structures
Presence of: • Wind turbine and OSP scour protection • Cable protection.	
Vessel Movement	Increased risk of introduction and spread of INNS Changes in physical processes
Presence of: • Wind turbine and OSP scour protection • Cable protection.	
Removal of: • Wind turbines • OSPs • Cable protection • Scour protection.	Removal of hard substrate

2.4.2.3 Effects which are not considered likely to be significant 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 2.7.

Table 2.7: Impacts scoped out of the assessment for benthic subtidal ecology.

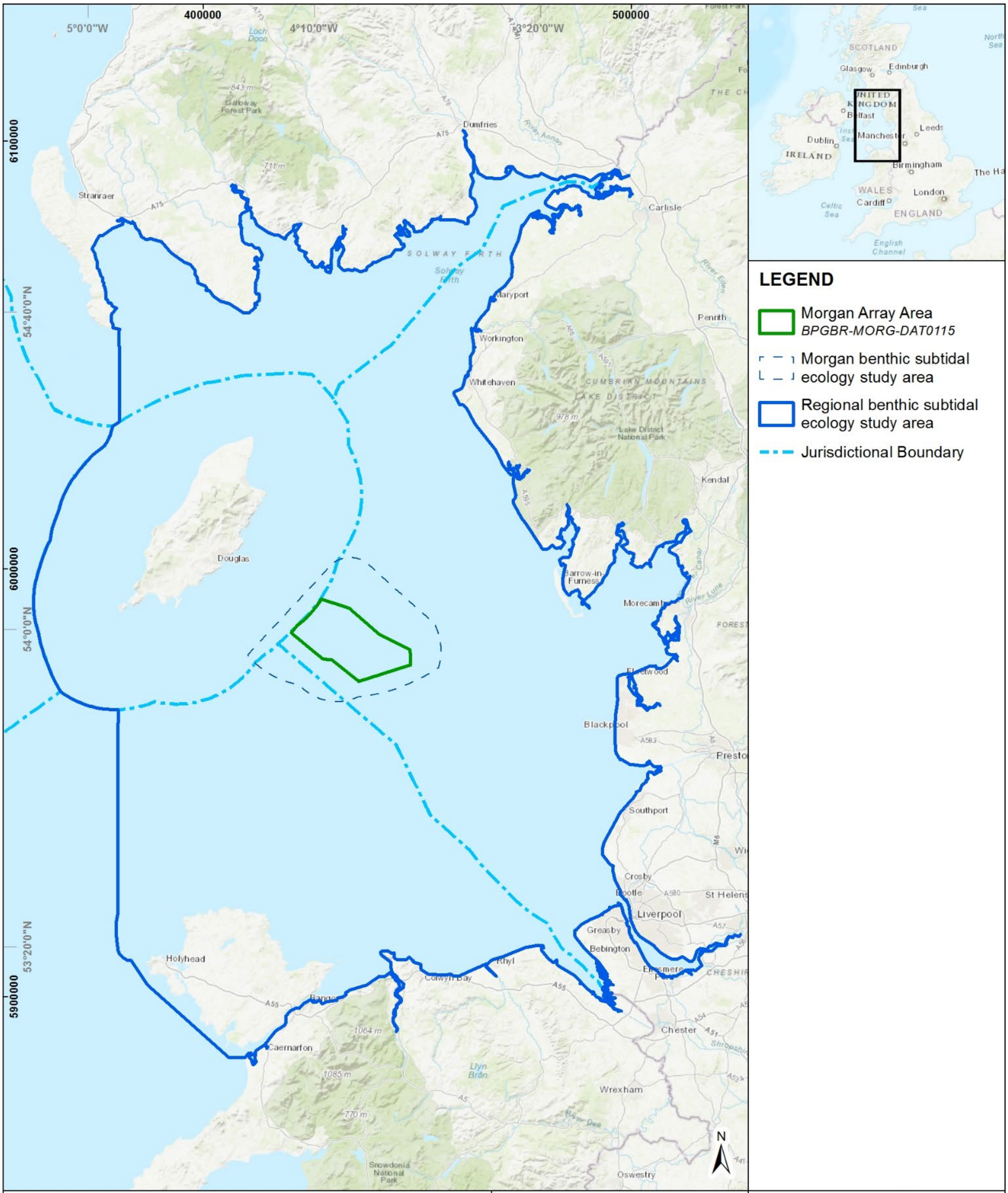
Potential impact	Justification
Accidental pollution during construction, operations and maintenance and decommissioning.	There is a risk of pollution being accidentally released during the construction, operations and maintenance and decommissioning phases from sources including vessels/vehicles and equipment/machinery. However, the risk of such events is managed by the implementation of measures set out in standard post-consent plans (e.g. EMP, including MPCP). These plans include planning for accidental spills, address all potential contaminant releases and include key emergency contact details. It will also set out industry good practice and OSPAR (Oslo-Paris), International Maritime Organisation (IMO) and MARPOL (International Convention for the Prevention of Pollution from Ships) guidelines for preventing pollution at sea. Therefore, the likelihood of an accidental spill occurring is very low and in the unlikely event that such events did occur, the magnitude of these will be minimised through measures such as a MPCP. As such, this potential impact was scoped out of further consideration within this chapter. The SNCBs and the Planning Inspectorate agreed through their Scoping responses that the impact of accidental pollution could be scoped out of the assessment.

2.4.3 Methodology to inform baseline

2.4.4 Study area

2.4.4.1 For the purposes of the benthic subtidal ecology assessment, three study areas have been defined:

- The Morgan benthic subtidal ecology study area has been defined as the area encompassing the Morgan Array Area. It also includes one tidal excursion around the Morgan Array Area referred to as the ZoI. These are the areas within which the site-specific benthic baseline characterisation surveys have been undertaken (Figure 2.1). This study area was consulted on throughout the EPP where it was presented to SNCBs, regulators and other stakeholders (e.g. Natural England, NRW, JNCC, MMO and Isle of Man Government) who all agreed with the approach.
- The regional benthic subtidal ecology study area encompasses the wider east Irish Sea habitats and includes the neighbouring consented offshore wind farms and designated sites (Figure 2.1). It has been characterised by desktop data and provides a wider context to the site-specific data within the Morgan benthic subtidal ecology study area.
- The CEA Morgan benthic subtidal ecology study area has been defined as a 50 km buffer around the Morgan Array Area (Figure 2.6). 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 Morgan Generation 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 which is defined as two tidal excursions.



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Data Sources: Client

Project Name:
MORGAN OFFSHORE WIND PROJECT

0 2.5 5 10 15 20 nm
0 5 10 20 30 40 km

Drawing Number:
RPSE-MG-ES-BEN-E001-00

Drawing Title:
MORGAN BENTHIC SUBTIDAL ECOLOGY STUDY AREA AND THE REGIONAL BENTHIC SUBTIDAL ECOLOGY STUDY AREA.

Geodetic Information:
Datum: ETRS 1989
Projection: ETRS 1989 UTM Zone 30N
Scale@160mmx220mm: 1:1,500,000

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Figure 2.1: Morgan benthic subtidal ecology study areas.

2.4.5 Desktop study

2.4.5.1 Information on benthic subtidal ecology within the benthic subtidal ecology study area was collected through a detailed desktop review of existing studies and datasets. These are summarised at Table 2.8 below.

Table 2.8: Summary of key desktop reports.

Title	Source	Year	Author
Mona Offshore Wind Project benthic subtidal and intertidal ecology technical report	Mona Offshore Wind Ltd.	2024	Mona Offshore Wind Ltd.
Morecambe Offshore Windfarm benthic characterisation survey report	Morecambe Offshore Windfarm Ltd.	2023	Morecambe Offshore Windfarm Ltd.
Morgan and Morecambe Offshore Wind Farms: Transmission Assets benthic subtidal and intertidal ecology technical report for the PEIR	Morgan Offshore Wind Ltd and Morecambe Offshore Wind Farm Ltd	2023	Morgan Offshore Wind Ltd and Morecambe Offshore Wind Farm Ltd
OneBenthic	Cefas	2021	Cefas
Marine recorder public UK snapshot	Joint Nature Conservation Committee (JNCC)	2020	JNCC
National Biodiversity Network (NBN) Atlas	NBN Atlas	2019	NBN Atlas
EMODnet broad scale seabed habitat map for Europe (EUSeaMap)	EMODnet – Seabed Habitats	2019	EMODnet – Seabed Habitats
JNCC Marine Protected Area (MPA) mapper	JNCC	2019	JNCC
Subtidal Ecology. In: Manx Marine Environmental Assessment (2nd Ed).	The Government of the Isle of Man	2018	Lara Howe
Coastal Ecology. In: Manx Marine Environmental Assessment (2nd Ed).	The Government of the Isle of Man	2018	Lara Howe
Burbo Bank extension benthic and Annex I habitat pre-construction survey	Marine Data Exchange	2015	Centre for Marine and Coastal Studies Ltd (CMACS)
Rhiannon offshore wind project Preliminary Environmental Information Report - Benthic Ecology	Marine Data Exchange	2014	Celtic Array Ltd
Walney Year 3 post consent benthic monitoring survey report	Marine Data Exchange	2014	CMACS
Burbo Bank extension environmental statement - benthic ecology	Marine Data Exchange	2013	Dong Energy Ltd.
Walney Extension environmental statement. chapter 10 benthic ecology	Marine Data Exchange	2013	Dong Energy

Title	Source	Year	Author
Walney Year 2 post-consent benthic monitoring survey report	Marine Data Exchange	2013	CMACS
Ormonde Year 1 post-construction benthic environmental monitoring survey	Marine Data Exchange	2012	CMACS
Burbo Bank Year 3 post construction benthic monitoring survey	Marine Data Exchange	2010	CMACS
Walney pre-construction monitoring report	Marine Data Exchange	2009	CMACS
Gwynt y Môr offshore wind farm baseline characterisation	Marine Data Exchange	2005	CMACS
Burbo Bank pre-construction contaminants investigation	Marine Data Exchange	2005	CMACS
Marine Nature Conservation Review (MNCR) areas summaries- Liverpool Bay and the Solway Firth	JNCC	1998	Covey. R.

2.4.6 Identification of designated sites

2.4.6.1 All designated sites within the regional benthic subtidal ecology study area and qualifying interest features that could be affected by the construction, operations and maintenance, and decommissioning phases of the Morgan Generation Assets were identified using the three-step process described below:

- Step 1: All designated sites of international, national and local importance within the regional benthic subtidal ecology study area were identified using a number of sources. These sources included the Department for Environment, Food and Rural Affairs (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 Morgan Array Area
    - Sites and associated qualifying interests were located within the potential ZoI for impacts associated with the Morgan Generation Assets. The ZoI was determined through project specific outputs from the marine processes assessment (Volume 2, Chapter 1: Physical processes of the Environmental Statement).

2.4.7 Site specific surveys

2.4.7.1 In order to inform this chapter, site-specific surveys were undertaken, as agreed with the JNCC, Natural England and NRW (see Table 2.9 for further details). A summary of the surveys undertaken to inform the benthic subtidal ecology impact assessment is outlined in Table 2.9 below.

Table 2.9: Summary of site-specific survey data.

Title	Extent of survey	Overview of survey	Survey contractor	Date	Reference to further information
Pre-construction site investigation surveys	Morgan Array Area	Geophysical survey to establish bathymetry, seabed sediment and identify seabed features.	XOcean Ltd	June 2021 to March 2022	Volume 4, Annex 1.1: Physical processes technical report of the Environmental Statement and Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement.
		High resolution side scan sonar and multibeam bathymetry.	Gardline Ltd.	June to September 2021	
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	Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement
	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	

2.5 Baseline environment

2.5.1 Sediment characteristics (geophysical survey)

2.5.1.1 Across the Morgan Array Area the seabed sediments predominantly comprised gravelly sand, with varying amounts of associated shell fragments. This aligns with the grab sampling particle size analysis data which showed the Morgan Array Area to be dominated by gravelly muddy sand and gravelly sand (paragraph 2.5.2.1). In the east of the Morgan Array Area, the sediments comprised predominantly shelly sand with prominent megaripples. Across the central Morgan benthic subtidal ecology study area, sandwaves were present and were associated with an increased gravel content in the sediments. In the west of the Morgan Array Area, an increased sonar reflectivity resulted from an increased gravel content.

2.5.1.2 Geophysical surveys were not conducted throughout the Morgan Array Area ZoI however surveys for the Morgan and Morecambe Offshore Wind Farms: Transmission Assets crossed some of the north, south and east of the Morgan Array Area ZoI (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023). Ripples were present at seabed over the majority of the Morgan and Morecambe Offshore Wind Farms: Transmission Assets including within the Morgan Array Area ZoI, with patches of featureless seabed.

2.5.2 Subtidal seabed sediments

2.5.2.1 Subtidal sediments recorded from infaunal grab samples collected across the Morgan Array Area during the site-specific benthic subtidal surveys ranged from gravelly sand to muddy sandy gravel with most samples classified as gravelly muddy sand or gravelly sand (Figure 2.2). Across the Morgan Array Area ZoI sediments ranged from muddy sandy gravel to gravelly muddy sand, with the majority of samples classified as sand (Figure 2.2). According to the simplified Folk Classification (Long, 2006), most stations were classified as mixed or coarse sediments. This aligned with the desktop data which indicated coarse sediments, sand and coarse sediments across the Morgan benthic subtidal ecology study area (EMODnet, 2019).

2.5.2.2 The percentage sediment composition (i.e. mud ≤0.63 mm; sand <2 mm; gravel ≥2 mm) at each grab sample station in the Morgan Array Area was also determined. Across all sample stations in the Morgan Array Area and ZoI, the average percentage sediment composition was 12.52% gravel, 79.53% sand and 7.95% mud, with sand making up the highest proportion of the sediment composition. Sediments across the Morgan Array Area and ZoI were typically poorly sorted or very poorly sorted, and a small number of samples were classified as moderately sorted.

2.5.3 Subtidal sediment contamination

2.5.3.1 As part of the subtidal sediment contamination analysis of samples within the Morgan Array Area and ZoI, levels of heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) and Polychlorinated Biphenyls (PCBs) were identified and compared to Cefas Action Levels 1 and 2 (AL1 and AL2) and the Canadian Environmental Quality Guidelines (CSQGs) (i.e. Probable Effect Level (PEL) and Threshold Effect Level (TEL)). Levels of Polycyclic Aromatic Hydrocarbons (PAHs) were identified and compared to the Canadian TEL and PEL thresholds as well as the National Oceanic and Atmospheric Administration Effects Range Low (ERL) and Effects Range Median (ERM) thresholds.

2.5.3.2 In summary, no contaminants were found to exceed Cefas AL2 or the Canadian PEL. Levels of arsenic, however, exceeded the Canadian TEL at 17 out of the 24 sample stations and exceeded Cefas AL1 at one station in Morgan Array Area and two stations in the Morgan Array Area ZoI but all sample stations were below the Cefas AL2 and Canadian PEL. Levels of organotins were below the Limit of Detection (LOD) at all stations sampled. Concentrations of PCBs were typically recorded below the LOD across the Morgan benthic subtidal ecology study area with the exception of two stations. The levels of the ICES-7 PCBs and total PCBs were however below the relevant Cefas AL1 and the Canadian TEL thresholds. Concentrations of PAHs were below the Canadian TEL (where one is specified). PAH concentrations were also well below their respective ERL values.

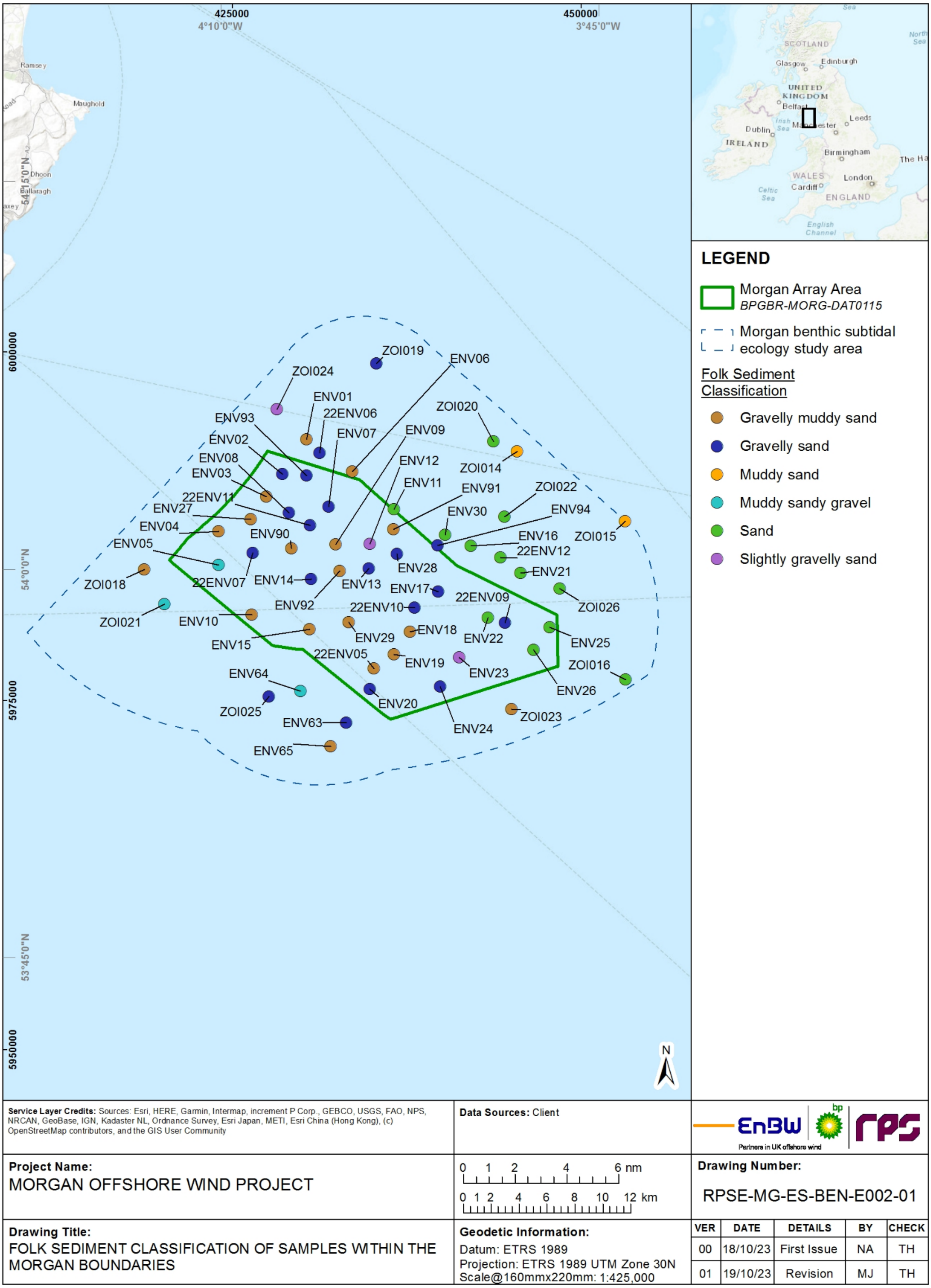


Figure 2.2: Folk sediment classifications for benthic grab samples in Morgan benthic subtidal ecology study area.

2.5.4 Subtidal biotopes and habitats

2.5.4.1 Across the Morgan Array Area, the infaunal communities were generally dominated by Annelida and Crustacea. The most abundant individuals generally belonged to Annelida with the polychaete *Scalibregma inflatum* being overall the most abundant species with a total of 936 individuals recorded. The biomass data reflected the dominance of Mollusca and Annelida with respect to the number of individuals and number of taxa, at 41% of station Mollusca contributed the most to biomass and at 30% of stations Annelida contributed the most to biomass.

2.5.4.2 The epifaunal communities recorded by the seabed imagery varied according to the type of sediment. In general, high numbers of epifaunal species were recorded in association with the coarser sediments. Epifaunal species recorded were dominated by Annelida and Cnidaria with low numbers of Mollusca. Some of the most prominent species across the Morgan Array Area and ZoI included *Paguroidea*, *Alcyonium digitatum*, *Tubularia*, *Nematoda, Ceriantharia* and *Ophiura albida*.

2.5.4.3 A full description of the habitats and biotopes recorded in the site-specific benthic surveys in the Morgan benthic subtidal ecology study area, including full descriptions of the biotope codes discussed in this section and shown in Figure 2.3, are provided in Volume 4, Annex 2.1: Benthic ecology technical report of the Environmental Statement. Figure 2.3 also includes biotopes which were determined as part of the Mona Offshore Wind Project, which partially overlap with the Morgan Array Area ZoI. The benthic communities in the Morgan Array Area were characterised by four biotopes.

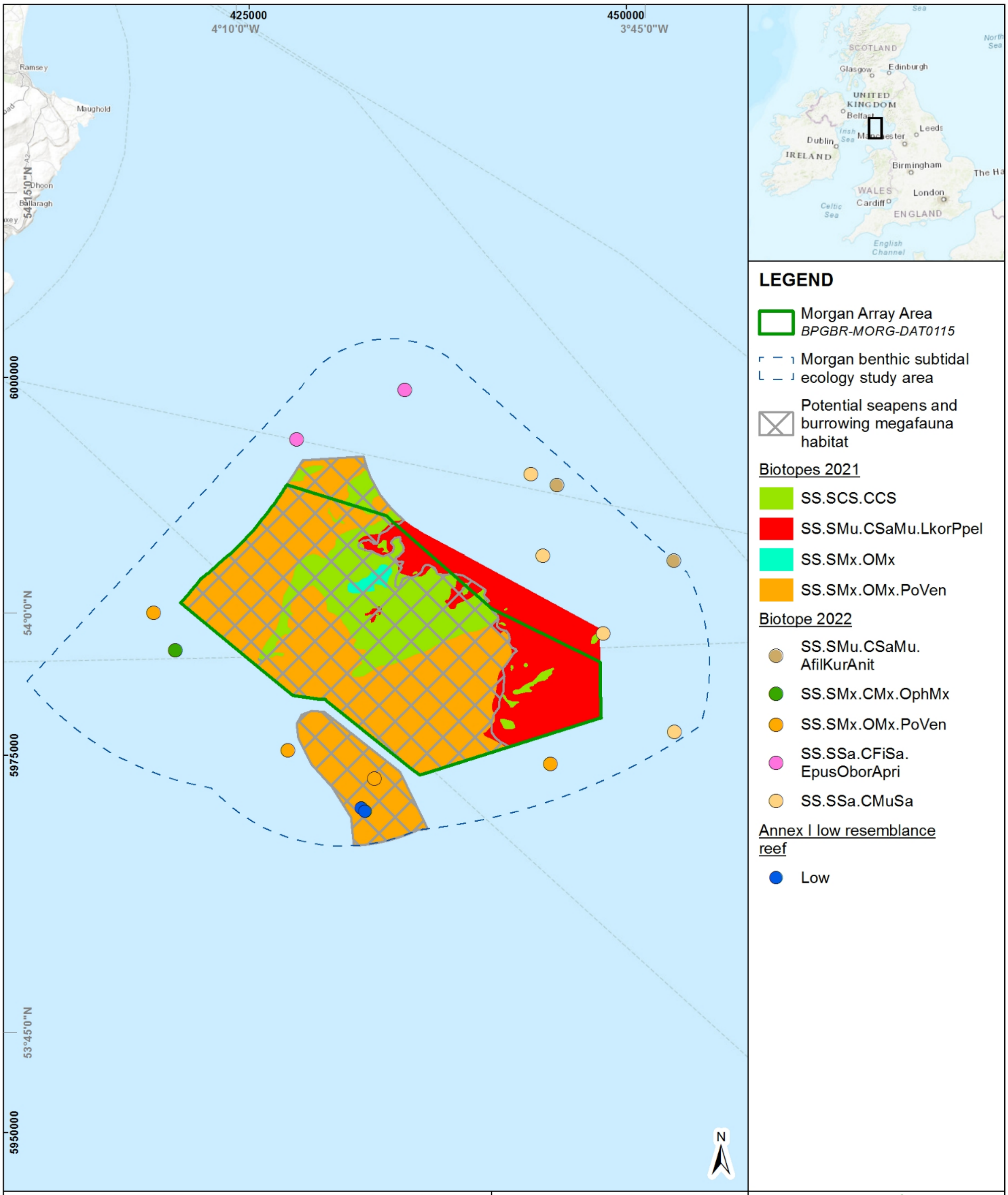
2.5.4.4 In the west of the Morgan Array Area the polychaete-rich deep Venus community in offshore mixed sediments (SS.SMx.OMx.PoVen) biotope was dominant. Figure 2.3 shows that the SS.SMx.OMx.PoVen biotope was the most extensive biotope recorded within the Morgan Array Area, characterising the communities in the north and along the west boundary and extending into the south and east of the Morgan Array Area as well as further south into the Mona Offshore Wind Project. This biotope is characterised by a diverse community particularly rich in polychaetes potentially with a significant venerid bivalve component. Species present in this biotope included polychaetes such as *Glycera lapidum*, *Aonides paucibranchiata*, and *Mediomastus fragilis* as well as the echinoderm *Echinocyamus pusillus*. A similar biotope, offshore circalittoral mixed sediment (SS.SMx.OMx) was recorded in a small area in the centre of the Morgan Array Area. The sediments and communities in areas of the SS.SMx.OMx biotope were characterised by polychaetes, bivalves and Nemertea. Species recorded in this biotope included *Kurtiella bidentata, E. pusillus, Pholoe baltica, Glycera lapidum, Syllis armillaris* and *Urothoe marina.*

2.5.4.5 The circalittoral coarse sediment biotope (SS.SCS.CCS) was recorded across the central sections of the Morgan Array Area, with smaller areas in the north and east of the Morgan Array Area. The SS.SCS.CCS biotope was characterised by a robust community of infaunal polychaetes, mobile crustacea and bivalves which included species such as *Scoloplos armiger*, *Owenia* sp., Nemertea and *Abra* sp.

2.5.4.6 In the east of the Morgan Array Area, the *Lagis koreni* and *Phaxas pellucidus* in circalittoral sandy mud (SS.SMu.CSaMu.LkorPpel) biotope was dominant extending along the northeast and east boundaries. The communities associated with this biotope were also characterised by polychaetes and bivalves with most species adapted to sandy habitats such as *L. koreni, Spiophanes bombyx* and *P. baltica*.

2.5.4.7 The Morgan Array Area ZoI was predominantly characterised by the SS.SMx.OMx.PoVen biotope which extended across the east, and south of the

Morgan Array Area ZoI. Also in the south of the Morgan Array Area ZoI the *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment (SS.SMx.CMx.OphMx) biotope was identified at one sample station. The SS.SMx.CMx.OphMx biotope was characterised by circalittoral sediments dominated by brittlestars (*Ophiothrix fragilis* and/or *Ophiocomina nigra*) which had formed dense beds. In the north of the Morgan Array Area ZoI the *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (SS.SSa.CFiSa.EpusOborApri) biotope was identified at two stations. This biotope occurs in offshore medium to fine sand and is characterised by a variety of polychaetes and bivalves as well as the characterising species included in its name. In the north west of the Morgan Array Area ZoI the *Amphiura filiformis*, *Kurtiella bidentata* and *Abra nitida* in circalittoral sandy mud (SS.SMu.CSaMu.AfilKurAnit) biotope was identified at two sample stations. This biotope occurs in muddy sands in moderately deep water and is characterised by a variety of polychaetes as well as the characterising species included in its name.



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Data Sources: Client, Guardline, EMODnet, Seabed Habitats (2021)

Project Name:
MORGAN OFFSHORE WIND PROJECT

0 1 2 4 6 nm
0 1 2 4 6 8 10 12 km

Drawing Number:
RPSE-MG-ES-BEN-E003-00

Drawing Title:
COMBINED INFAUNAL AND EPIFAUNAL BIOTOPE MAP OF THE MORGAN BENTHIC SUBTIDAL ECOLOGY STUDY AREA (ALL BIOTOPE CODES ARE DEFINED IN APPENDIX G).

Geodetic Information:
Datum: ETRS 1989
Projection: ETRS 1989 UTM Zone 30N
Scale@160mmx220mm: 1:425,000

VER	DATE	DETAILS	BY	CHECK
00	18/10/23	First Issue	NA	TH

Figure 2.3: Combined infaunal and epifaunal biotope map of the Morgan benthic subtidal ecology study area (data for the Mona Offshore Wind Project is also displayed for wider context)[2].

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[2] The biotope codes used in this figure are defined in full in the text and in Appendix G in Volume 4, Chapter 2.1: Benthic subtidal technical report of the Environmental Statement.

2.5.5 Habitat assessment

2.5.5.1 Several stations within the Morgan benthic subtidal ecology study area were taken forward for further assessment to determine their potential to align with features of habitats of conservation importance. These included assessments for the presence of the 'seapens and burrowing megafauna communities', Annex I stony reef and the fragile sponge and anthozoan communities on rocky habitat.

Seapens and burrowing megafauna

2.5.5.2 Across the Morgan Array Area and ZoI small pencil burrows were observed in the site specific surveys. Although no seapens were observed the JNCC (2014a) guidance stipulates that 'seapens and burrowing megafauna communities' habitat can occur without 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. Where burrows were identified the maximum density of burrows varied from 0.02 burrows per m^2 at ZOI22 to 6.62 burrows per m^2 at ENV73 (within the Morgan Array Area ZoI). It should be noted that the maximum burrow density is considered to be highly precautionary. This is because total burrows per image were not recorded, rather burrows were assigned a range (i.e. 1 to 5, 6 to 10 etc.) and, to determine the maximum burrow density, the top end of the range bracket was used to obtain the maximum total number of burrows and from that the density then calculated.

2.5.5.3 At stations where burrows were observed the majority of burrows within the Morgan benthic subtidal ecology study area were very small and in the 0 to 1 cm size range category. Burrow density was not identified as greater than 'frequent' on the SACFOR scale at any station. Within the Morgan Array Area 43% of stations subject to an analysis of this habitat had an average SACFOR abundance of 'frequent', decreasing to 21% in the Morgan Array Area and ZoI.

2.5.5.4 Very few burrows were observed at stations where soft sediment was dominant. In combination with an absence of associated fauna and gravelly sediment, it was concluded that no stations had anything other than a negligible resemblance to the 'seapens and burrowing megafauna communities' habitat.

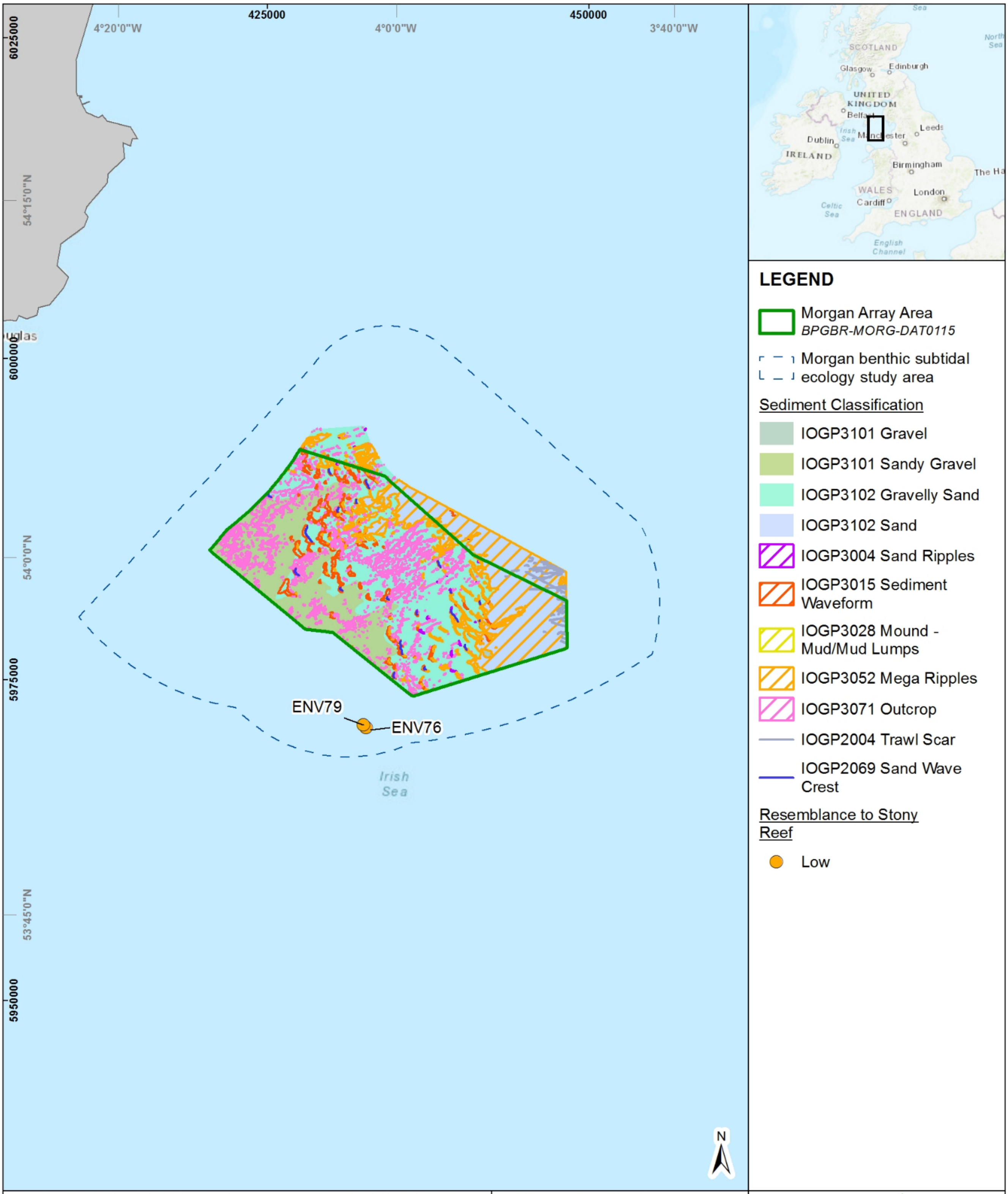
2.5.5.5 However, in order to adopt a precautionary approach and on the basis that burrows were observed at an average SACFOR of 'frequent' at 24 stations, these stations have, for the purposes of the assessment, been assumed to represent the 'seapens and burrowing megafauna communities' habitat. It should be noted however, that during the site-specific surveys no seapens were recorded in the Morgan benthic subtidal ecology study area and the sediment is considered unlikely to be consistent with this habitat (i.e. sediments were predominantly gravelly muddy sand). This approach is therefore deemed to be highly precautionary.

Annex I stony reef

2.5.5.6 Seabed imagery indicated no areas of potential stony reef within the Morgan Array Area during the site-specific surveys.

2.5.5.7 The seabed imagery indicated potential stony reef at two stations within the Morgan Array Area ZoI, to the south of the Morgan Array Area. As a result, an Annex I stony reef assessment was undertaken to determine if there was a resemblance to the protected habitat based on criteria set out by Irving (2009) and Golding *et al.* (2020) considering sediment composition, elevation, extent and ecological communities. Both stations within the Morgan Array Area ZoI were found on raised bathymetric features composed of cobbles and boulders. When images meeting one or more reef criteria were encountered in a few images or with large areas separating the image station it was overall determined to have no resemblance. Both stations identified within the Morgan Array Area ZoI were classified as low resemblance to Annex I stony reef (Figure 2.4). All other sample stations which were assessed had no resemblance to stony reefs.

2.5.5.8 In conclusion these assessments have concluded that Annex I low resemblance stony reef was present at two stations within the Morgan Array Area ZoI.



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Data Sources: Client, Guardline

EnBW bp Partners in UK offshore wind rps

Project Name:
MORGAN OFFSHORE WIND PROJECT

0 1 2 4 6 nm
0 2.5 5 10 km

Drawing Number:
RPSE-MG-ES-BEN-E005-00

Drawing Title:
RESULTS OF THE STONY REEF ASSESSMENT WITHIN THE MORGAN BENTHIC SUBTIDAL AND INTERTIDAL ECOLOGY STUDY AREAS

Geodetic Information:
Datum: ETRS 1989
Projection: ETRS 1989 UTM Zone 30N
Scale@160mmx220mm: 1:500,000

VER	DATE	DETAILS	BY	CHECK
00	18/10/23	First Issue	NA	TH

Figure 2.4: Results of the Annex I reef (Stony reef) assessment within the Morgan Generation Assets benthic subtidal ecology study area.

Fragile sponge and anthozoan communities on subtidal rocky habitats

2.5.5.9 Hard substrate Porifera were observed across the Morgan Array Area and ZoI, with 17 stations showing evidence of Porifera. This evidence largely comprised images showing an average of less than 1% of the image occupied by lone sponges such as cf. *Polymastia* sp., cf. *Suberites* sp. and cf. *Tethya* sp. At sample station 22ENV07 a total of 57 still images were analysed, and sponge (*Suberites*) was only recorded in a single image at a percentage cover of 2.59%. This was the greatest percentage occupied by Porifera in a single image across the Morgan benthic subtidal ecology study area. Although several of the sponge species present, and non-sponge species (e.g. *Nemertesia* sp.), are listed within the description for the fragile sponge and anthozoan communities on rocky habitats which are Biodiversity Action Plan (BAP) Priority Habitats (JNCC, 2008; JNCC, 2014b), they were only recorded at very low abundances and therefore, no stations, were considered to represent this habitat. On the basis of the above, the ‘fragile sponge and anthozoan communities on rocky habitat’ community was not considered to be present anywhere within the Morgan benthic subtidal ecology study area.

2.5.6 Designated sites

2.5.6.1 Designated sites identified for consideration in the benthic subtidal ecology chapter are described below in Table 2.10. All designated sites including SSSIs, SACs, Ramsar sites, MNRs and MCZs within the regional benthic subtidal ecology study area were identified within Volume 4, Annex 2.1: Benthic ecology technical report of the Environmental Statement. The designated sites, and their relevant qualifying benthic features, that could be affected by the construction, operations and maintenance, and decommissioning of the Morgan Generation Assets (i.e. that fall within the potential ZoI of the Morgan Generation Assets), were identified using the process described below:

- Sites with relevant benthic ecology features which overlap with the Morgan Generation Assets and therefore have the potential to be directly affected (e.g. by temporary and/or long-term habitat loss)
- Sites with relevant benthic ecology features with the potential to be indirectly affected by the Morgan Generation Assets (i.e. by changes in SSCs and/or sediment deposition as determined by the assessment presented in Volume 2, Chapter 1: Physical processes of the Environmental Statement).

2.5.6.2 All other designated sites, including the MNRs around the Isle of Man, are outside the ZoI and so will not be affected by the Morgan Generation Assets. These sites have, therefore, not been considered further in this chapter.

Table 2.10: Designated sites and relevant qualifying interests for the Morgan benthic subtidal ecology chapter.

Designated site	Closest distance to the Morgan Array Area (km)	Relevant qualifying interest
West of Copeland MCZ	8.8	• Subtidal coarse sediment • Subtidal sand • Subtidal mixed sediment.
West of Walney MCZ	9.3	• Subtidal sand • Subtidal mud • Seapens and burrowing megafauna communities.

2.5.6.3 The consideration of the features of each MCZ is in line with relevant best practice guidance provided by Natural England and JNCC (2022).

Designated sites baseline

West of Copeland MCZ

2.5.6.4 The West of Copeland MCZ is characterised by its sedimentary protected features (subtidal sand, subtidal coarse sediment and subtidal mixed sediment) all of which are identified to be in an unfavourable condition with the general management approach to return these features to a favourable condition (JNCC, 2022a).

2.5.6.5 The subtidal mixed sediment designated feature occupies the smallest area within the MCZ, extending across the majority of the boundary in the north of the site. This feature is composed of a range of sediments including muddy gravelly sands and mosaics of cobbles and pebbles as well as physical features such as sand ribbons and lag deposits (JNCC, 2022b). The biological communities in this feature are equally varied with a wide range of infauna and epibionts, including polychaetes, bivalves, echinoderms, anemones, hydroids and bryozoans (Connor *et al*., 2004).

2.5.6.6 The subtidal sand designated feature covers a large area of the West of Copeland MCZ with the largest areas of this features found in the north and south of the site. This feature is composed of medium to fine sand or slightly muddy sand (JNCC, 2022b). This feature is subject to a degree of tidal current which restricts the silt and clay content (JNCC, 2022b). Biologically this feature is characterised by polychaetes, bivalve molluscs and amphipods (Connor *et al*., 2004).

2.5.6.7 The subtidal coarse sediment designated feature is largely found in the centre of the West of Copeland MCZ and is comprised of coarse sand, gravel, pebbles, shingle and cobbles. These sediments typically have a low silt content and are characterised by robust fauna, including venerid bivalves (Connor *et al*., 2004).

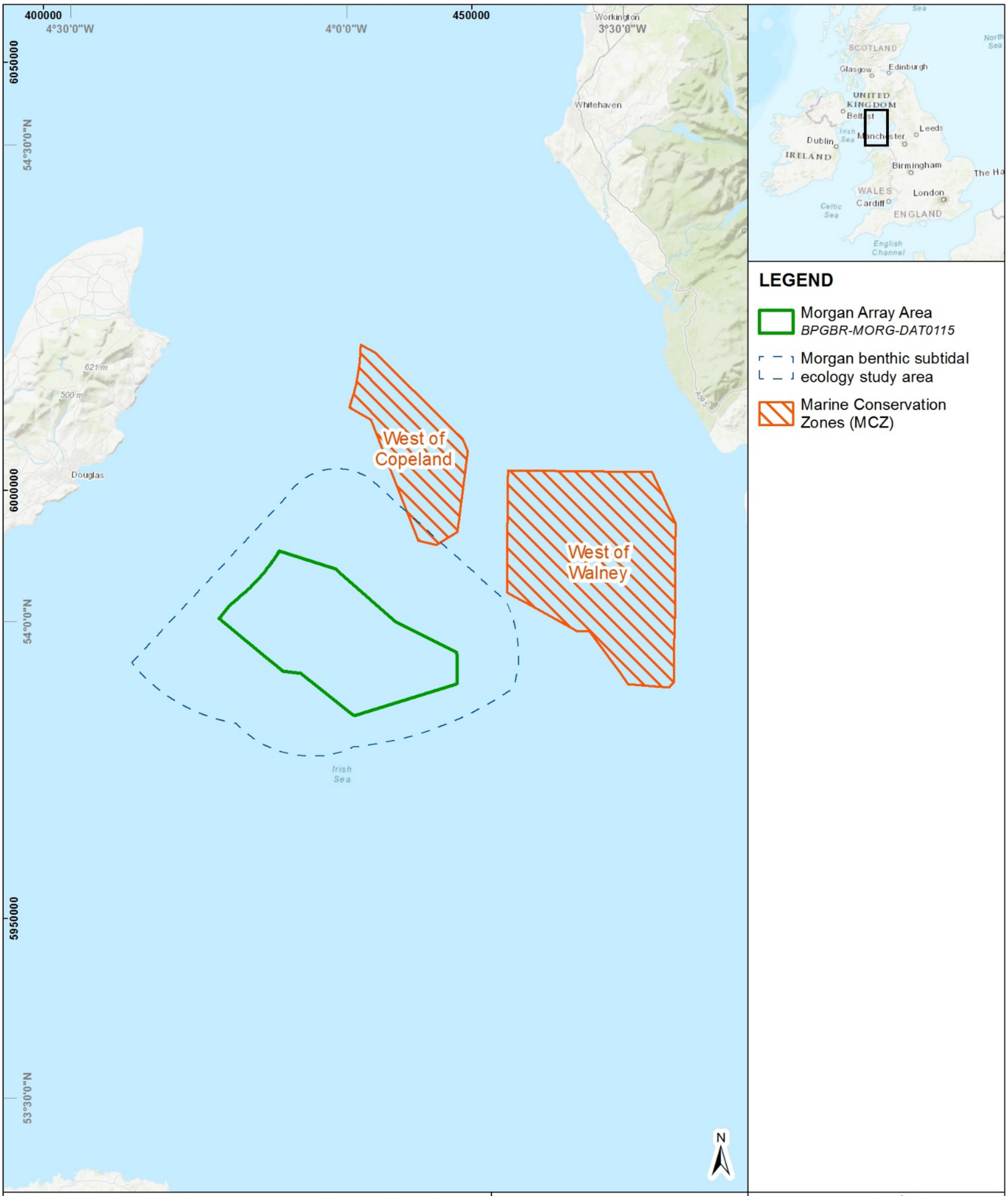
West of Walney MCZ

2.5.6.8 The West of Walney MCZ is characterised by its sedimentary protected features (subtidal sand and subtidal mud) as well as protected marine habitat (seapens and burrowing megafaunal communities), all of which are identified to be in an unfavourable condition with the general management approach to return these features to a favourable condition (DEFRA, 2016).

2.5.6.9 The subtidal mud designated feature is the most extensive feature within the MCZ and is part of the wider Irish Sea mud belt. The subtidal mud is an important habitat for a range of animals including worms, molluscs, sea urchins, crustaceans (MMO, 2018). Other larger animals, such as mud shrimps, live within this habitat and burrow into the mud (MMO, 2018). This creates networks of burrows which shelter smaller creatures like worms and brittlestars (MMO, 2018). The subtidal mud biotope *Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral sandy mud was considered to best describe the infaunal community within this broadscale habitat (European Environment Agency, 2016).

2.5.6.10 The subtidal muds also provide a habitat for seapens, which are tall, erect and luminous animals which live in groups (MMO, 2018). The representative communities of this feature are encompassed by the seapens and burrowing megafauna in circalittoral fine mud biotope (European Environment Agency, 2016). Many of the burrows observed in the MCZ will have been created by burrowing decapods such as *Upogebia deltaura*, *Callianassa subterranean*, *Jaxea nocturna*, *Goneplax rhomboides*, and *Nephrops norvegicus*, all of which have been recorded in surveys within the MCZ (NIRAS Consulting Ltd, 2015). Other organisms, characteristic of the seapens and burrowing megafauna community that are found in the MCZ, include the spoon worm, *Maxmuelleria lankasteri*, the burrowing sea urchin, *Brissopsis lyrifera*, and the seapen *Virgularia mirabilis* (Ocean Ecology, 2015).

2.5.6.11 The subtidal sand designated feature within this MCZ has only been identified within a small area in the northeast of the site. It is an important habitat as flatfish and sand eels camouflage themselves on the surface of it, and it supports burrowing megafauna communities, such as the Norway lobster (*Nephrops norvegicus*) (MMO, 2018). The subtidal sands within the MCZ also support high densities of burrowing brittlestars (MMO, 2018). Samples from this area have been described as a reasonable match to the biotope *Mysella bidentata* and *Thyasira* spp. In circalittoral muddy mixed sediment (Centre for Marine and Coastal Studies Ltd, 2009) and *Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral sandy mud (Centre for Marine and Coastal Studies Ltd, 2014).



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Data Sources: Client. NaturalEngland

Project Name:
MORGAN OFFSHORE WIND PROJECT

0 1 2 4 6 8 10 nm
0 2.5 5 10 15 20 km

Drawing Number:
RPSE-MG-ES-BEN-E006-01

Drawing Title:
DESIGNATED SITES WITH BENTHIC HABITAT FEATURES SCREENED INTO THE MORGAN BENTHIC SUBTIDAL ECOLOGY ASSESSMENT

Geodetic Information:
Datum: ETRS 1989
Projection: ETRS 1989 UTM Zone 30N
Scale@160mmx220mm: 1:750,000

VER	DATE	DETAILS	BY	CHECK
00	18/10/23	First Issue	NA	TH
01	11/04/24	Revision	MJ	TF

Figure 2.5: Designated sites with benthic habitat features screened into the Morgan benthic subtidal ecology assessment.

2.5.7 Important ecological features

2.5.7.1 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 ecology EIA, IEFs have been identified. The potential impacts of the Morgan Generation 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 Morgan Generation Assets. Importance may be assigned due to quality or extent of habitats, habitat or species rarity or the extent to which they are threatened (CIEEM, 2019). 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, The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), National Biodiversity Plan or the Marine Strategy Framework Directive).

2.5.7.2 All of the IEFs within the Morgan benthic subtidal ecology study area are listed in Table 2.11. The main habitats identified throughout the Morgan benthic subtidal ecology study area comprise five subtidal habitat IEFs. Within the wider regional benthic subtidal ecology study area, the designated features of the West of Walney MCZ and the West of Copeland MCZ are also included as IEFs.

Table 2.11: IEFs within the regional benthic subtidal ecology study area.

IEF	Description and representative biotopes	Conservation interest/Protected Status	Location	Importance within the regional benthic subtidal ecology study area
Subtidal habitats				
Subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes	Sand and muddy sand, characterised by tube building polychaete *Lagis koreni*, and other polychaetes such as *Mediomastus fragilis* and *Spiophanes bombyx*, as well as bivalves and arthropods. Identified within the Morgan Array Area. • SS.SSa.CMuSa • SS.SMu.CSaMu.AfilKurAnit • SS.SMu.CSaMu.LkorPpel • SS.SSa.CFiSa.EpusOborApri.	UK BAP priority habitat Habitat of Principal Importance in England (NERC Act 2006)	In the west of the Morgan benthic subtidal ecology study area (i.e. within the Morgan Generation Assets Red Line Boundary)	National

IEF	Description and representative biotopes	Conservation interest/Protected Status	Location	Importance within the regional benthic subtidal ecology study area
Subtidal coarse and mixed sediments with diverse benthic communities	Subtidal coarse and mixed sediments characterised by polychaetes, bivalves and mobile crustaceans. Identified within the Morgan Array Area. • SS.SCS.CCS[3] • SS.SMx.OMx • SS.SMx.OMx.PoVen.	UK BAP priority habitat Habitat of Principal Importance in England (NERC Act 2006)	Centre and east of the Morgan benthic subtidal ecology study area (i.e. within the Morgan Generation Assets Red Line Boundary)	National
Brittlestar beds	Subtidal mixed sediment dominated by brittlestars which form dense beds. • SS.SMx.CMx.OphMx.	UK BAP priority habitat Habitat of Principal Importance in England (NERC Act 2006)	Southwest of the Morgan Array Area ZoI (i.e. outside the Morgan Generation Assets Red Line Boundary)	National
Annex I low resemblance stony reef (outside an SAC)	Cobbles and boulders with indicator species such as *A. digitatum*, *Nemertesia* sp. and *Tubularia* sp. • CR.HCR.XFa.SpNemAdia.	Annex I habitat outside an SAC	South of the Morgan Array Area ZoI (i.e. outside the Morgan Generation Assets Red Line Boundary)	National
Seapens and burrowing megafauna communities	Plains of fine mud at depths greater than about 15 m may be heavily bioturbated by burrowing megafauna. • SS.SMu.CFiMu.SpnMeg.	UK BAP priority habitat OSPAR habitat Habitat of Principal Importance in England (NERC Act 2006)	Morgan Array Area and south of Morgan Array Area ZoI (i.e. within the Morgan Generation Assets Red Line Boundary)	National
West of Walney MCZ				
Subtidal mud	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	UK BAP priority habitat Protected feature of an MCZ Habitat of Principal Importance in England (NERC Act 2006)	Within wider regional benthic subtidal ecology study area (i.e. outside the Morgan Generation Assets Red Line Boundary)	National

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[3] This biotope which was recorded within the Morgan benthic subtidal ecology study area was not present in the MarESA therefore SS.SCS.CCS.MedLumVen biotope has been used as a proxy for sensitivity.

IEF	Description and representative biotopes	Conservation interest/Protected Status	Location	Importance within the regional benthic subtidal ecology study area
Subtidal sand	Sand seascapes with infaunal polychaetes and bivalves. • SS.SMu.CSaMu.AfilKurAnit • SS.SMx.CMx.KurThyMx	UK BAP priority habitat Habitat of Principal Importance in England (NERC Act 2006) Protected feature of an MCZ	Within wider regional benthic subtidal ecology study area (i.e. outside the Morgan Generation Assets Red Line Boundary)	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	OSPAR habitat Habitat of Principal Importance in England (NERC Act 2006) Protected feature of an MCZ	Within wider regional benthic subtidal ecology study area (i.e. outside the Morgan Generation Assets Red Line Boundary)	National
West of Copeland MCZ				
Subtidal coarse sediment[4]	Coarse sand and gravel or shell fragments. Largely characterised by infaunal communities include bristleworms, sand mason worms, burrowing anemones and bivalves. • SS.SCS.CCS	UK BAP priority habitat Protected feature of an MCZ	Within wider regional benthic subtidal ecology study area (i.e. outside the Morgan Generation Assets Red Line Boundary)	National
Subtidal mixed sediment[5]	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	Protected feature of an MCZ Habitat of Principal Importance in England (NERC Act 2006)	Within wider regional benthic subtidal ecology study area (i.e. outside the Morgan Generation Assets Red Line Boundary)	National
Subtidal sand[6]	Sand seascapes with infaunal polychaetes and bivalves. • SS.SMu.CSaMu.AfilKurAnit	UK BAP priority habitat Habitat of Principal Importance in England (NERC Act 2006) Protected feature of an MCZ	Within wider regional benthic subtidal ecology study area (i.e. outside the Morgan Generation Assets Red Line Boundary)	National

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[4] No known biotopes have been allocated for this IEF in the literature therefore biotopes have been assigned based on descriptions of the physical environment and the biological communities.

[5] No known biotopes have been allocated for this IEF in the literature therefore biotopes have been assigned based on descriptions of the physical environment and the biological communities.

[6] No known biotopes have been allocated for this IEF in the literature therefore biotopes have been assigned based on descriptions of the physical environment and the biological communities.

2.5.8 Future baseline scenario

2.5.8.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017) requires 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 Environmental Statement. In the event that the Morgan Generation Assets do not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

2.5.8.2 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 (OESEA3)) (Department of Energy and Climate Change, 2016). 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 nutrients (Department of Energy and Climate Change, 2016), with climatic process driving shifts in abundances and species composition of benthic. Benthic communities are also currently being influenced by anthropogenic activities including, contamination or seabed disturbing activities such as trawling, dredging and development. 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 to 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 seabed 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).

2.5.9 Data limitations

2.5.9.1 The data sources used in this chapter are detailed in Table 2.8. The desktop data used are the most up to date, publicly available information which can be obtained from the applicable data sources as cited. To ensure an up-to-date baseline characterisation, the site-specific benthic subtidal ecology survey data have been validated with site-specific geophysical surveys undertaken in 2021 and 2022.

2.5.9.2 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 Morgan benthic subtidal ecology study area. Due to the limitations described previously, the biotope map shown in Figure 2.3 should not be interpreted as definitive areas. However, this does provide a suitable baseline characterisation which describes the main habitats and communities within the Morgan benthic subtidal ecology study area for the purposes of the assessment.

2.6 Impact assessment methodology

2.6.1 Overview

2.6.1.1 The benthic subtidal ecology impact assessment has followed the methodology set out in Volume 1, Chapter 5: EIA methodology of the Environmental Statement. Specific to the benthic subtidal 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)
- Refining the criteria for defining areas with a ‘low resemblance’ to Annex I stony reef (Golding *et al*, 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 JNCC, 2022).

2.6.1.2 In addition, the benthic subtidal ecology impact assessment has considered the legislative framework as defined by:

- The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (relevant to the application for development consent)
- The Planning Act 2008 (as amended) (relevant to the application for development consent)
- Marine and Coastal Access Act 2009.

2.6.2 Impact assessment criteria

2.6.2.1 The criteria for determining the significance of effects is a two-stage process that involves defining the magnitude of the impacts and the sensitivity of the receptors. This section describes the criteria applied in this chapter to assign values to the magnitude of potential 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: EIA methodology of the Environmental Statement.

2.6.2.2 The criteria for defining magnitude in this chapter are outlined in Table 2.12 below.

Table 2.12: Definition of terms relating to the magnitude of an impact.

Magnitude of impact	Definition
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse)
	Large scale or major improvement or resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial)
Medium	Loss of resource, but not adversely affecting integrity of resource; partial loss of/damage to key characteristics, features or elements (Adverse)
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial)
Low	Some measurable change in attributes, quality or vulnerability, minor loss or, or alteration to, one (maybe more) key characteristics, features or elements (Adverse)
	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 (Beneficial)
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse)
	Very minor benefit to, or positive addition of one or more characteristics, features or elements (Beneficial)
No change	No loss or alteration of characteristics, features or elements; no observable impact either adverse or beneficial.

2.6.2.3 The MarESA has been drawn upon to support the assessment of sensitivity of the benthic subtidal ecology IEFs within the Morgan benthic subtidal ecology study area.

2.6.2.4 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 2.7.1.2. The process for defining sensitivity in this chapter follows that defined by the MarESA sensitivity assessment, which correlates vulnerability (or resistance) and recoverability (or resilience) to categorise sensitivity, as set out in Table 2.13.

2.6.2.5 The sensitivities of benthic subtidal IEFs presented within this benthic subtidal ecology chapter of the Environmental Statement have therefore been defined by an assessment of the combined vulnerability (i.e. equivalent to resistance in 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 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 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 analogous activities such as those associated with aggregate extraction, electrical cabling, and oil and gas industries.

Table 2.13: Definition of terms relating to the sensitivity of the receptor (applicable to MarESA sensitivity assessment).[7]

Recoverability	Vulnerability			
	High	Medium	Low	None
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)

2.6.2.6 The conclusions of the MarESA assessment have been combined with the importance of the relevant IEFs as presented in Table 2.11 for the benthic subtidal IEFs considered in this assessment. The criteria for defining sensitivity in this chapter are outlined in Table 2.14 below.

Table 2.14: Definition of terms relating to the sensitivity of the receptor.

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 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 to impacts regardless of value/importance.

2.6.2.7 The significance of the effect upon benthic subtidal ecology is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 2.15. Where a

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[7] In this table the MarESA terms of resistance and resilience have been substituted with recoverability and vulnerability, respectively, to ensure consistency with the terms defined in Table 2.14 and to remain consistent with terminology and approach outlined in Volume 1, Chapter 5: EIA methodology of the Environmental Statement and adopted across the Morgan Generation Assets Environmental Statement.

range of significance of effect is presented in Table 2.15, the final assessment for each effect is based upon expert judgement.

2.6.2.8 For the purposes of this assessment, any effects with a significance level of minor or less have been concluded to be not significant in terms of the EIA Regulations.

Table 2.15: Matrix used for the assessment of the significance of the effect.

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

2.6.3 Designated sites

2.6.3.1 Where National Site Network sites (i.e. internationally designated sites) are considered, this chapter summarises the assessments made on the interest features of internationally designated sites as described within section 2.5.6 of this chapter (with the assessment on the site itself deferred to the ISAA (Document Reference E1.1, E1.2 and E1.3). With respect to nationally and locally designated sites, where these sites fall within the boundaries of an internationally designated site (e.g. SSSIs, MCZs and MNRs which have not been assessed within the ISAA Report), only the international site has been taken forward for assessment. This is because potential effects on the integrity and conservation status of the nationally designated site are assumed to be inherent within the assessment of the internationally designated site (i.e. a separate assessment for the national site is not undertaken).

2.6.3.2 The ISAA has been prepared in accordance with Advice Note Ten: Habitats Regulations Assessment relevant to Nationally Significant Infrastructure Projects (Planning Inspectorate, 2022).

2.7 Key parameters for assessment

2.7.1 Maximum design scenario

2.7.1.1 The MDS for each impact pathway identified in Table 2.16 has been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from Volume 1, Chapter 3: Project description of the Environmental Statement. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within Volume 1, Chapter 3: Project description of the Environmental Statement (e.g. different infrastructure layout), to that assessed here be taken forward in the final design scheme.

Table 2.16: Maximum design scenario considered for the assessment of potential impacts on benthic subtidal ecology.

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

Potential impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
Temporary habitat loss/disturbance	✓	✓	✓	**Construction phase** Up to 61,422,400 m^2 of habitat loss/disturbance in total across the Morgan Array Area comprising: • Jack-up events: up to 825,600 m^2 of disturbance from the use of jack-up vessels during foundation installation, with up to four jack-up events at each of 96 wind turbines (two jack-up events for wind turbines and two jack-up events for the foundations) and two jack-up events at each of four OSPs • Sandwave clearance for foundations: up to 818,960 m^2 of habitat disturbance associated with sandwave clearance comprising: – 721,561 m^2 of sandwave clearance associated with seabed preparation for wind turbine foundations – 97,399 m^2 of sandwave clearance associated with seabed preparation for OSP foundations • Cable installation (including sandwave clearance and pre-lay preparation): up to 21,384,000 m^2 of disturbance comprising: – Inter-array cables: up to 17,160,000 m^2 disturbance from installation of up to 390 km of inter-array cables (assumes 60% requires boulder clearance with a 20 m width of disturbance and 40% requires sandwave clearance with an 80 m width of disturbance) – Interconnector cables: up to 4,224,000 m^2 disturbance from installation of up to 60 km of interconnector cables (assumes 40% requires boulder clearance with a 20 m width of disturbance and 60% requires sandwave clearance with a 104 m width of disturbance) • Sandwave clearance material deposition: Up to 36,473,840 m^2 of habitat disturbance associated with the deposition of sandwave clearance material comprising: – 20,298,910 m^2 from deposition of 10,149,455 m^3 of sandwave clearance material associated with seabed preparation for wind turbine and OSP foundations	**Construction phase:** • Maximum footprint which would be affected during the construction, operations and maintenance and decommissioning phases. • The MDS assumes 100% of all cables are buried. • The MDS assumes that the width of disturbance for sandwave and pre-lay preparation (boulder and debris clearance) also includes subsequent burial. • For the purposes of the MDS, and to avoid double counting of the total footprint with sandwave clearance activities, the MDS assumes up to 60% of inter-array and 40% of interconnector will be subject to pre-lay preparation (boulder and debris clearance) only. The MDS assumes that the remainder of the cables will be subject to sandwave clearance. • 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 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 5 m height. The MDS assumes temporary loss of benthic habitat is beneath this.

Potential impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				– 10,053,302 m^2 from deposition of 5,026,651 m^3 of sandwave clearance material associated with seabed preparation for inter-array cables – 6,121,628 m^2 from deposition of 3,060,814 m^3 of sandwave clearance material associated with seabed preparation for interconnectors cables • Anchor placement: Up to 1,000,000 m^2 of habitat disturbance from from two 100 m^2 anchor set placements (five anchors per set) every 500 m per inter-array cable link during installation • Cable removal: Up to 920,000 m^2 from the removal of 46,000 m of disused cables • UXO removal: clearance of up to 13 UXOs within the Morgan Array Area ranging from 25 kg up to 907 kg with 130 kg the most likely (common) maximum. • Temporary disturbance from anchor chains associated with mooring systems (e.g. gravity based anchors) for: – Up to 25 light buoys and marker buoys (cardinal buoys, although the final number will be determined by Maritime and Coastguard Agency (MCA)/Trinity House requirements – Up to four power utility buoys for electrified vessel charging – Other buoys including LiDAR buoys, waverider buoys, buoys for potential noise monitoring, wave measurement buoys, and mooring buoys for transportation vessels. • Maximum duration of the offshore construction phase is up to four years. **Operations and maintenance phase** Up to 11,362,800 m^2 of temporary habitat disturbance in total across the Morgan Array Area due to: • Up to 1,822,800 m^2 of temporary habitat disturbance due to jack-ups at wind turbines and OSPs, over the lifetime of the Morgan Generation Assets for the following: – Up to 840 major component replacements (one every four years for each location) for wind turbines – 12 major component replacements (three over the lifetime per OSP) for OSPs	• Maximum number and maximum size of UXOs encountered in the Morgan Array Area. Due to uncertainties in size of UXOs the assessment presents a range, highlighting the most likely size (common) to be encountered. **Operations and maintenance phase:** • The MDS for habitat disturbance associated with inter-array and interconnector cable maintenance includes repairs/reburial of subtidal cables. **Decommissioning phase:** • Parameters for decommissioning will be significantly lower than for the construction phase as sandwave clearance and pre-lay preparations will not be required in advance of cable removal and cable protection and scour protection are assumed to be left *in situ*. • MDS assumes the complete removal of all wind turbine and OSP foundations and cables; piles will be cut below the seabed.

Potential impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				– Four access ladder replacements and four modifications to/replacement of J-tubes for wind turbines – Four access ladder replacements and four modifications to/replacement of J-tubes for OSPs. • Up to 4,720,000 m^2 of temporary habitat disturbance due to inter-array cable maintenance associated with: – 2,800,000 m^2 from seven reburial events (one every five years) affecting up to 20,000 m per reburial event – 1,920,000 m^2 from 12 repair events (one every three years) affecting up to 8,000 m per cable repair event – Assuming 20 m width seabed disturbance for repair and remedial burial • Up to 4,820,000 m^2 of temporary habitat disturbance due to interconnector cable maintenance associated with: – 420,000 m^2 from seven reburial events (one every five years) affecting up to 3,000 m per reburial event – 4,400,000m^2 from 12 repair events (three every 10 years) affecting up to 20,000 m per cable repair event – Assuming 20 m width seabed disturbance for repair and remedial burial. • Operations and maintenance phase will be up to 35 years. **Decommissioning phase** Temporary subtidal habitat loss/disturbance due to: • Cable removal: disturbance from the removal of 390 km of inter-array cables and 60 km of interconnector cables • Jack-up events: disturbance from the use of jack-up vessels during foundation removal • Anchor placements: habitat disturbance from anchor placements during cable removal.	
Increased suspended sediment concentrations (SSC) and associated deposition	✓	✓	✓	**Construction phase** Site preparation: Sandwave clearance:	**Construction phase** Site preparation: • The volume of material to be cleared from individual sandwaves will vary according to

Potential impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				• Sandwave clearance activities undertaken over an approximate 12-month duration within the wider four-year construction programme • Wind turbines and OSP foundations: sandwave clearance has been calculated on the basis of wind turbine generator foundations and an assumption of clearance at up to 60% of locations. Spoil volume per location has been calculated on the basis of 41 locations supporting the largest suction bucket four-legged jacket foundation with an associated base diameter of 205 m to an average depth of 7.5 m. This equates to a total spoil volume of 10,149,455 m^3 and a volume of 247,548 m^3 per location • Inter-array cables: sandwave clearance along 156 km of cable length, with a width of 80 m, to an average depth of 3 m. Total spoil volume of 5,026,651 m^3 • Interconnector cables: sandwave clearance along 36 km of cable length, with a width of 104 m, to an average depth of 5.1 m. Total spoil volume of 3,060,814 m^3 • Removal of up to 46 km of disused cables. Foundation installation: • Undertaken over an approximate 12-month duration • Wind turbines: installation of 45 with three-legged jacket piles of 5.5 m diameter, drilled to a depth of 75 m at a rate of up to 1.45 m/h. Spoil volume of 2,107 m^3 per pile • Wind turbines: installation of 23 conical gravity base foundations with a caisson diameter of 37 m and a sea surface diameter 15 m. Installation requires dredging of a maximum area of 32,761 m^2 to a maximum depth of 10 m • OSPs: installation of one large OSP with six legs with three piles per leg, each 5.5 m drilled to a depth of 75 m at a rate of up to 1.45 m/h. Spoil volume of 2,107 m^3 per pile • Two drilled piles installed concurrently at adjacent sites. Cable installation: • Inter-array cables: Installation via trenching of up to 390 km of cable, with a trench width of up to 3 m and a depth of up to 3 m. Total maximum spoil	the local dimensions of the sandwave (height, length, and shape) and the level to which the sandwave must be reduced. These details are not fully known at this stage, however based on the available data, it is anticipated that the sandwaves requiring clearance in the array area are likely to be in the range up to 15 m in height. This will be confirmed pre-construction. In all cases the material cleared from the sandwave will be sidecast, (i.e. placed in close proximity to the breach) in order that the sediment is readily available for supply for sandwave recovery. The exception to this will be if the material is used for ballast within the foundation structure (see foundation installation below). • For gravity based foundations, sandwave clearance volumes are a maximum of 110,992 m^3 per foundation therefore less than those for the suction bucket foundations even when it is assumed all locations require clearance therefore suction bucket foundations form the MDS. • 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 relocation of material. In reality plough dredging may be implemented however the volume of material brought into suspension would be reduced as material is ploughed along the bed. • Boulder clearance activities will result in minimal increases in suspended sediment

Potential impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				volume of 1,755,000 m^3. Installed over a period of approximately 12 months - Interconnector cables: installation via trenching of up to 60 km of cable, with a trench width of up to 3 m and a depth of up to 3 m with a V-shaped cross-section. Total spoil volume of 270,000 m^3. Installed over a period of approximately four-months. **Operations and maintenance phase** - Inter-array cables: repair of up 8 km of cable in one event every three years. Reburial of up to 20 km of cable in one event every five years - Interconnector cables: repair of up to 19.6 km of cable in each of three events every 10 years. Reburial of up to 3 km of cable in one event every five years. - Operations and maintenance phase will be up to 35 years. **Decommissioning phase** - Scour and cable protection will remain *in situ*. If suction caissons are removed using the overpressure to release them then suspended sediment concentration will be temporarily increased - Inter-array and interconnector cables will be removed and disposed of onshore.	concentrations and have therefore not been considered in the assessment. Foundation installation: - The dredging and site preparation associated with conical gravity base foundations may involve the use of up to 7,000 m^3 of this material as ballast within the structure. The remaining material will be sidecast in close proximity to be available within the sediment cell for transport and sandwave regeneration. - Installation of foundations via augured (drilled) operations results in the release of the largest volume of sediment unrestrained through the water column. The greatest volume of sediment disturbance by drilling at individual locations is associated with the largest diameter pile for wind turbines. It is noted that it is unlikely that drilling would be required to the full depth and the most likely scenario is that piles would be driven, with no drilling required. This would give rise to minimal increases in SSC, however the most arduous scenario has been assessed as the MDS. - The maximum number of three legged jacket pile foundations to be installed for the largest wind turbine generators is 45 out of an array of 68 wind turbine generators. Therefore, for the holistic approach of SSC assessment the remaining 23 foundations are conical gravity based foundations with associated dredging activities. - The selected OSP scenario represents the greatest volume of sediment to be released for a drilling event.

Potential impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
					• The greatest drilling rate associated with the largest pile diameter represents the maximum level of increase in suspended sediment concentration. 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. • Cables may be buried by ploughing, trenching or jetting with trenching or jetting mobilising the greatest volume of material to increase suspended sediment concentrations. **Operations and maintenance phase** • The greatest foreseeable number of cable reburial and repair events is considered to 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.
Disturbance/remobilisation of sediment-bound contaminants	✓	×	✓	**Construction phase** Maximum design scenario as described above for increased SSC and associated deposition during the construction phase.	The justification for the disturbance/remobilisation of sediment-bound contaminants MDS is the same as for the increased SSC and associated deposition impact above, as this MDS results in the

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Potential impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				Decommissioning phase Maximum design scenario as described above for increased SSC and associated deposition during the decommissioning phase.	release of the largest volume of sediment and associated contaminants.
Long term habitat loss	✓	✓	✓	**Construction and operations and maintenance phase** Up to 1,309,252 m^2 of long term habitat loss in total across the Morgan Array Area over the lifetime of the Morgan Generation Assets associated with the following: • Presence of foundations and scour protection: up to 760,452 m^2 of habitat loss comprising: – Wind turbines: up to 735,488 m^2 from the presence of up to 68 wind turbine foundations on suction bucket four-legged jacket foundations with associated scour protection – OSPs: up to 24,964 m^2 from four OSPs on suction bucket four-legged jacket foundations with associated scour protection • Presence of cable protection for inter-array and interconnector cables: up to 510,000 m^2 of habitat loss comprising: – Inter-array cable protection: 390,000 m^2 associated with up to 10% of 390 km of inter-array cables (10 m width of cable protection) – Interconnector cable protection: 120,000 m^2 for up to 20% of 60 km of interconnector cables (10 m width of cable protection) • Presence of cable crossing protection: up to 38,800 m^2 of habitat loss comprising: – Cable protection for cable crossings for inter-array cables: 28,800 m^2 from 10 cable crossings (each up to 80 m in length and 36 m in width) – Cable protection for cable crossings for interconnector cables: 10,000 m^2 from 10 cable crossings (each up to 50 m in length and 20 m in width). • Presence of mooring systems (e.g. gravity based anchors) for: – Up to 25 light buoys and marker buoys (cardinal buoys, although the final number will be determined by MCA/Trinity House requirements – Up to four power utility buoys for electrified vessel charging	Largest wind turbine and OSP foundation type and associated scour protection, maximum length of cables and cable protection resulting in greatest extent of habitat loss. MDS for decommissioning (and permanent habitat loss following decommissioning) assumes removal of the foundations, if any additional infrastructure is decommissioned, this will result in a reduced area of permanent habitat loss. Greatest amount of cable and scour protection resulting in the largest area of infrastructure to be left *in situ* after decommissioning.

Potential impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				– Other buoys including LiDAR buoys, waverider buoys, buoys for potential noise monitoring, wave measurement buoys, and mooring buoys for transportation vessels. • Operations and maintenance phase will be up to 35 years. **Decommissioning phase** Up to 1,252,116 m^2 of permanent subtidal habitat loss due to scour and cable protection left *in situ* post decommissioning.	
Introduction of artificial structures	✓	✓	✓	**Construction and operations and maintenance phase** Introduction of up to 1,791,198 m^2 of artificial structures over the lifetime of the Morgan Generation Assets comprising: • Wind turbines and OSPs: Presence of up to 68 wind turbines and four OSPs on suction bucket jacket foundations • Scour protection: Presence of scour protection for wind turbine foundations and OSP foundations • Cable protection: Presence of cable protection associated with up to 10% of the 390 km of inter-array cables and up to 20% of the 60 km of interconnector cables • Cable crossing protection: Presence of cable protection for cable crossings, 10 cable crossings for inter-array cables (each up to 80 m in length and 36 m in width) and 10 cable crossings for interconnector cables (each up to 50 m in length and 20 m in width). • Operations and maintenance phase will be up to 35 years. **Decommissioning phase** Up to 1,252,116 m^2 of artificial structures remaining post-decommissioning due to scour and cable protection being left *in situ*.	Maximum number of wind turbine and OSP foundations and associated scour protection, maximum length of cables and cable protection resulting in greatest surface area for colonisation. The estimate of area associated with the introduction of artificial structures from the presence of foundations has been calculated as if the foundations were a solid structure. This is, therefore, likely to be a conservative estimate of the introduction of artificial structures on the basis that the jacket foundations will have a lattice design rather than a solid surface. The MDS for decommissioning assumes removal of the foundations but that cable and scour protection could be left *in situ* after decommissioning.
Increased risk of introduction and spread of invasive non-native species (INNS)	✓	✓	✓	**Construction phase** Increased risk of INNS due to: • Long term introduction of artificial structures: up to 1,791,198 m^2 as set out in the introduction of artificial structures impact above	Maximum surface area created by offshore infrastructure and maximum number of vessel movements during construction, operations and maintenance and decommissioning phases.

Potential impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				• Vessel movement: vessels associated with site preparation, wind turbine installation, OSP installation and inter-array cables with up to 1,929 vessel round trips in total over the construction phase • Maximum duration of the offshore construction phase is up to four years. **Operations and maintenance phase** Increased risk of INNS due to: • Long term introduction of artificial structures: up to 1,791,198 m^2 as set out in the colonisation of hard structures impact above • Vessel return trips: Up to 719 vessel return trips per year during the operations and maintenance phase • Removal of marine growth from foundations or access ladders • Operations and maintenance phase will be up to 35 years. **Decommissioning phase** Increased risk of INNS due to: • Presence of artificial structures: up to 1,252,116 m^2 due to cable protection and protection for crossings left *in situ* post decommissioning. • Vessel return trips: Up to 1,929 decommissioning vessel return trips during the decommissioning phase • Maximum duration of the offshore decommissioning phase is up to four years.	
Removal of hard substrates	×	×	✓	**Decommissioning phase** Removal of up to 1,791,198 m^2 of artificial structures in total across the Morgan Array Area due to: • Wind turbine and OSPs (including scout protection): Removal of up to 68 suction bucket four-legged jacket foundations for wind turbines and up to four suction bucket four-legged jacket foundations for OSPs including all scour protection • Inter-array and interconnector cable protection: Removal of cable protection associated with up to 10% of 390 km of inter-array cables and 20% of the 60 km of interconnector cables • Cable crossing protection: Removal of cable protection for 10 cable crossings for inter-array cables (each up to 80 m in length and 36 m in	The Volume 1, Chapter 3: Project description of the Environmental Statement states that it is likely that cable and scour protection will likely be left *in situ* following decommissioing however the MDS for benthic receptors is that all hard substrate could be removed.

Potential impact	Phase[a] C	O	D	Maximum Design Scenario	Justification
				width) and 10 cable crossings for interconnector cables (each up to 50 m in length and 20 m in width).	
Changes in physical processes	×	✓	✓	**Operations and maintenance phase** Holistic MDS for tides, waves and sediment transport: • Wind turbines: 68 installations with four-legged suction bucket foundations, each jacket leg with a diameter of 5 m, spaced 48 m apart, and each bucket with a diameter of 16 m. Scour protection to a height of 2.5 m and extending 20 m from the bucket. Total footprint of 10,816 m^2 per wind turbine. • OSPs: one installation with a rectangular gravity base foundation, with an 80 m by 60 m dimension at the surface, a slab base dimension of 100 m by 80 m and with scour protection to a height of 2.6 m and extending 25 m from the base. Total footprint of 19,500 m^2. • Inter-array cables: cable protection along 39 km of the cable, with a height of up to 3 m and up to 10 m width. Up to 10 cable crossings, each crossing has a height of up to 4 m, a width of up to 36 m and a length of up to 80 m. • Interconnector cables: cable protection along 12 km of the cable, with a height of up to 3 m and up to 10 m width. Cable crossings are subject to further survey work. Assessments are carried out on the basis of up to ten crossings as a precautionary measure. Each cable crossing has a height of up to 3 m, a width of up to 20 m and a length of up to 50 m. Sediment budget • The dredging and site preparation associated with conical gravity base foundations may involve the use of up to a total of 490,000 m^3 of this material as ballast in structures at up to 96 locations. Up to 7,000 m^3 of material may be harvested from site preparation activities at any given site. **Decommissioning phase** • During the decommissioning phase the potential changes to the receptor pathway would gradually decrease from the operational MDS as structures are removed and cut below the seabed. • Scour and 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 Environmental Statement.
EMF from subsea electrical cabling	×	✓	×	**Operations and maintenance phase** Presence of inter-array and interconnector cables:	Maximum length of cables across the Morgan Array Area and minimum burial depth (the

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Potential impact	Phase[a] C	O	D	Maximum Design Scenario	Justification
				• Inter-array cables: between 390 km of inter-array cables of 66 kV to 132 kV • Interconnector cables: up to 60 km of 275 kV High Voltage Alternating Current (HVAC) cables • Minimum burial depth 0.5 m • The MDS assumes up to 10% of inter-array cables and 20% of interconnector cables may require cable protection • Cable protection: cables will also require cable protection at asset crossings (up to 10 crossings for inter-array cables and 10 crossings for interconnector cables) • Operations and maintenance phase will be up to 35 years.	greater the burial depth, the more the EMF is attenuated).
Heat from subsea electrical cables	×	✓	×	**Operations and maintenance phase** Presence of inter-array and interconnector cables: • Inter-array cables: between 390 km of inter-array cables of 66kV to 132kV • Interconnector cables: up to 60 km of 275kV HVAC cables • Minimum burial depth 0.5 m • The MDS assumes up to 10% of inter-array cables and 20% of interconnector cables may require cable protection • Cable protection: cables will also require cable protection at asset crossings (up to 10 crossings for inter-array cables and 10 crossings for interconnector cables) • Operations and maintenance phase will be up to 35 years.	Maximum length of cables across the Morgan Array Area and minimum burial depth (the greater the burial depth, the more the heat is dissipated).

2.7.1.2 The MDS when considering the impact on benthic subtidal ecology relates to the largest amount of seabed area disturbance/loss (i.e. resulting from the greatest footprint of wind turbines, longest cable route and largest OSP area etc.), the maximum release of material into the water column (i.e. for increases in SSC) and the largest obstruction to flow in the water column. The MDS has been defined for each impact pathway using the parameters in Volume 1, Chapter 3: Project description of the Environmental Statement as those having the potential to result in the greatest effect for that particular pathway and therefore may differ between impact pathways.

2.8 Measures adopted as part of the Morgan Generation Assets

2.8.1.1 For the purposes of the EIA process, the term 'measures adopted as part of the project' is used to include the following measures (adapted from Institute of Environmental Management and Assessment, 2016):

- Measures included as part of the project design. These include modifications to the location or design envelope of the Morgan Generation Assets which are integrated into the application for consent. These measures are secured through the consent itself through the description of the development and the parameters secured in the DCO and/or marine licence (referred to as primary mitigation in IEMA, 2016)
- Measures required to meet legislative requirements, or actions that are generally standard practice used to manage commonly occurring environmental effects and are secured through the DCO requirements and/or the conditions of the marine licence (referred to as tertiary mitigation in IEMA, 2016).

2.8.1.2 A number of measures (primary and tertiary) have been adopted as part of the Morgan Generation Assets to reduce the potential for impacts on benthic subtidal ecology. These are outlined in Table 2.17 below. As there is a secured commitment to implementing these measures, they are considered inherently part of the design of the Morgan Generation Assets and have therefore been considered in the assessment presented in section 2.9 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

Table 2.17: Measures adopted as part of the Morgan Generation Assets.

Measures adopted as part of the Morgan Generation Assets	Justification	How the measure will be secured
Primary measures: Measures included as part of the project design		
Development and adherence to an Offshore Construction method statement (CMS) including a Cable Specification and Installation Plan (CSIP) which will include cable burial where possible and cable protection.	To minimise potential impact from the cables and removal of cables a commitment to bury cables where possible has been made in accordance with the specific policies set out in the North West Offshore Coast Marine Plans (MMO, 2021). Cable burial will be used as a preference and cable protection where burial is not possible. This primary measure will help to reduce the amount of EMF which benthic organisms are exposed to during the operations and maintenance phase by increasing the distance between the seabed surface and the surface of the cables. It will also reduce the extent of long-term habitat loss associated with cable protection. The Applicant recognises that the best form of cable protection is achieved through cable burial to	The Offshore CMS is secured within the deemed marine licences of the draft DCO.

Measures adopted as part of the Morgan Generation Assets	Justification	How the measure will be secured
	the required depths, according to the results of a Cable Burial Risk Assessment and Burial Assessment Study, which will be included within the CSIP. The burial methodology should select the appropriate tools to endeavour to achieve burial to the required depth of lowering in a single pass, seeking to avoid burial methods that require multiple passes with a burial tool in order to achieve lowering of the cable.	
Development and adherence to an Offshore CMS, which will include details of scour protection management, to be used around offshore structures and foundations to reduce scour as much as is practical.	There is the potential for scouring of seabed sediments to occur due to interactions between metocean regime (waves and currents) and foundations or other seabed structures. This scouring can develop into depressions around the structure. The use of scour protection around offshore structures and foundations will be employed, as described in detail in Volume 1, Chapter 3: Project description of the Environmental Statement.	The Offshore CMS is secured within the deemed marine licences of the draft DCO.
No more than 5% reduction in water depth (referenced to Chart Datum) will occur without prior written approval from the Licensing Authority in consultation with the Maritime Coastguard Agency (MCA).	This will ensure any cable protection is sufficiently low profile to cause minimal changes to wave, tide and sediment transport.	A CSIP as part of the Offshore CMS secured within the deemed marine licences within the draft DCO (Document Reference C1).
Development and adherence to an Offshore CMS which includes a CSIP which requires that material arising from drilling and/or sandwave clearance will be deposited in close proximity to the works and within the licenced disposal area applied for (which is the Morgan Array Area).	To retain material within sediment cell and maintain sediment transport regimes.	The Offshore CMS is secured within the deemed marine licences of the draft DCO
Development and adherence to an Offshore CMS, which will include details to minimise sandwave clearance volumes and will be included within the CSIP.	Following the publication of Scoping and PEIR, project refinement has been undertaken to identify opportunities to reduce clearance volumes. Inter-array cable corridor widths and areas have been refined and the volumes of sandwave clearance have been significantly reduced. The commitment to minimise sandwave clearance volumes is included in the project design presented in Volume 1, Chapter 3: Project description of the Environmental Statement.	The Offshore CMS is secured within the deemed marine licences of the draft DCO.
Tertiary measures: Measures required to meet legislative requirements, or adopted standard industry practice		
Development of, and adherence to, an Offshore EMP. This will include Biosecurity Risk Assessment and an INNS Management Plan, including actions to minimise INNS.	The plan will outline measures to ensure vessels comply with the 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 *Didemnum vexillum*).	The Offshore EMP is secured within the deemed marine licences of the draft DCO.

Measures adopted as part of the Morgan Generation Assets	Justification	How the measure will be secured
Development and adherence to an Offshore EMP that will include a MPCP which will include planning for accidental spills, address all potential contaminant releases and include key emergency details.	This will ensure that the potential for release of pollutants from construction, operations and maintenance and decommissioning activities is reduced so far as reasonably practicable.	The Offshore EMP is secured within the deemed marine licences of the draft DCO.

2.8.1.3 Where significant effects have been identified, further mitigation measures (referred to as secondary mitigation in IEMA, 2016) have been identified to reduce the significance of effect to acceptable levels following the initial assessment. These are measures that could further prevent, reduce and, where possible, offset any adverse effects on the environment. These measures are set out, where relevant, in section 2.9 below.

2.9 Assessment of significant effects

2.9.1 Impact pathway summary

2.9.1.1 The impacts of the construction, operations and maintenance and decommissioning phases of the Morgan Generation Assets have been assessed on benthic subtidal ecology. The potential impacts are listed in Table 2.16 along with the MDS against which each impact has been assessed. The potential impacts are also listed in Table 2.18 together with the IEFs which have been assessed for each potential impact pathway.

2.9.1.2 A description of the potential effect on benthic subtidal ecology receptors caused by each identified impact is given below.

Table 2.18: Summary of IEFs assessed for each potential impact pathway for the Morgan Generation Assets alone assessment.

IEF	Temporary habitat loss/disturbance	Increase in suspended sediment concentrations and associated	Disturbance/remobilisation of sediment-bound contaminants	Long term habitat loss/habitat alteration	Introduction of artificial structures	Increased risk of introduction and spread of invasive non-native	Removal of hard substrates	Changes in physical processes	Electromagnetic fields from subsea electrical cables	Heat from subsea electrical cables
Subtidal habitat IEFs										
Subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Subtidal coarse and mixed sediments with diverse benthic communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Brittlestar beds	✗	✓	✗	✗	✗	✗	✗	✓	✗	✗
Annex I low resemblance stony reef (outside an SAC)	✗	✓	✗	✗	✗	✗	✗	✓	✗	✗
Seapens and burrowing megafauna communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
West of Walney MCZ										
Subtidal mud	✗	✓	✗	✗	✗	✗	✗	✓	✗	✗
Subtidal sand	✗	✓	✗	✗	✗	✗	✗	✓	✗	✗
Seapens and burrowing	✗	✓	✗	✗	✗	✗	✗	✓	✗	✗

IEF	Temporary habitat loss/disturbance	Increase in suspended sediment concentrations and associated	Disturbance/remobilisation of sediment-bound contaminants	Long term habitat loss/habitat alteration	Introduction of artificial structures	Increased risk of introduction and spread of invasive non-native	Removal of hard substrates	Changes in physical processes	Electromagnetic fields from subsea electrical cables	Heat from subsea electrical cables
megafauna communities										
West of Copeland MCZ										
Subtidal coarse sediment	×	✓	×	×	×	×	×	✓	×	×
Subtidal mixed sediment	×	✓	×	×	×	×	×	✓	×	×
Subtidal sand	×	✓	×	×	×	×	×	✓	×	×

2.9.2 Temporary subtidal habitat disturbance

2.9.2.1 Temporary habitat loss/disturbance of subtidal habitats within the Morgan benthic ecology subtidal study area will occur during the construction, operations and maintenance and decommissioning phases. Temporary habitat loss/disturbance may result from activities including the use of jack-up vessels during the installation of foundations for wind turbines and OSPs, sandwave clearance, pre-lay preparation (e.g. boulder and debris clearance), UXO clearance, cable installation and repair as well as anchor placements associated with these activities. There may also be some temporary habitat disturbance associated with the deployment and operation of various buoys within the Morgan Array Area (including light buoys, marker buoys, LiDAR buoys, waverider buoys, noise monitoring buoys, wave measurement buoys and mooring buoys). Temporary habitat disturbance may also arise as a result of the removal of disused/out of service cables. The MDS for temporary habitat loss/disturbance is summarised in Table 2.16.

2.9.2.2 The relevant MarESA pressures and their benchmarks which have used to inform this impact assessment are described here:

- 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)
- 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 operations, anchor placements and the installation/operation of buoys

- 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 and jack-up vessel operations
- 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 foundation installation and cable installation.

2.9.2.3 The subtidal habitat IEFs that have the potential to be affected by temporary habitat loss/disturbance across all phases of the Morgan Generation Assets are those present within the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF (see Table 2.18)).

Construction phase

Magnitude of impact

2.9.2.4 The installation of the Morgan Generation Assets infrastructure within the Morgan benthic subtidal ecology study area may lead to up to 61,422,400 m^2 of temporary habitat loss/disturbance during the construction phase (Table 2.16). This equates to approximately 6.43% of the Morgan benthic subtidal ecology study area.

2.9.2.5 Temporary habitat disturbance in the construction phase is likely to result from pre-lay preparations (sandwave and boulder and debris clearance and associated deposition), UXO clearance, jack-up events, cable installation and cable removal. Additionally the deployment of buoys may result in temporary habitat disturbance. Long term habitat loss associated with the footprint of the wind turbine foundations and associated scour protection is considered as a separate impact in section 2.9.5.

2.9.2.6 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 80 m for inter-array 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 50,107,820 m^2 to 21,384,000 m^2 post-PEIR.

2.9.2.7 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. A recent 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).

2.9.2.8 Sandwave clearance and cable installation may take place within the subtidal coarse and mixed sediments with diverse benthic communities IEF and the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF. The subtidal coarse and mixed sediments with diverse benthic communities IEF covers the majority of the Morgan Array Area (82%) and so the majority of impact will be to this IEF and to a lesser extent the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF (18%). As a result it is possible 82% of the temporary habitat disturbance associated with the Morgan Generation Assets will occur within the subtidal coarse and mixed sediments with diverse benthic communities IEF (accounting for 50,366,368 m^2 of disturbance) and 18% may occur in the *Lagis koreni* and other polychaetes IEF (accounting for 11,056,032 m^2 of disturbance). This can only however be an estimate as the exact position of the infrastructure within the Morgan Array Area is not yet known. As detailed in paragraphs 2.9.2.13 and 2.9.2.14 these IEFs are likely to recover from activities of this nature. Any mounds of cleared material will 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, benthic assemblages would be expected to recolonise these areas (see paragraphs 2.9.2.13 and 2.9.2.14 below).

2.9.2.9 The MDS also includes for the clearance of up to 13 UXOs within the Morgan Generation Assets with a 130 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 (25 kg which is greater than the minimum considered for the Morgan Generation 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 Morgan Generation 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 project is committed to applying low order/low yield techniques where safe and logistically viable to do so and therefore UXO clearance will most likely be within the 20 m width 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 80 m width of disturbance assumed for sandwave clearance for inter-array and 104 m width of disturbance assumed for sandwave clearance for interconnector cables. 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.

2.9.2.10 The maximum duration of the offshore construction phase for the Morgan Generation Assets is up to four years. Within the four-year construction phase, construction activities are anticipated to occur intermittently with only a small proportion of the MDS footprint being affected at any one time.

2.9.2.11 The impact on the subtidal habitat IEFs in the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) is predicted to be of local spatial extent, short to 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**.

Sensitivity of the receptor

2.9.2.12 Subtidal habitat IEFs which are expected to be affected by temporary subtidal habitat loss/disturbance are listed in paragraph 2.9.2.3 and Table 2.18. The sensitivity of the subtidal habitat IEFs to temporary subtidal habitat loss/disturbance is presented in Table 2.19. These sensitivities are based on assessments made by the MarESA.

2.9.2.13 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF has an overall medium sensitivity to temporary habitat loss/disturbance. The biotope which characterises this IEF will likely be detrimentally affected by the movement of sediment during sandwave clearance. Newell *et al*. (1998) state that removal of 0.5 m depth of sediment is likely to eliminate benthos from the affected area. One of the key characterising species, *Lagis koreni,* inhabits the top 10 cm of the sediment (Mayhew, 2007) and would be incapable of reconstructing their delicate sand-tubes once removed from them, resulting in mortality (Schäfer, 1972). However, the recovery of the habitat is likely to occur through infilling or before infilling if the sediment exposed is the same as that removed (De-Bastos and Watson, 2023). Furthermore, *Lagis koreni* is short lived and quick to mature as well as capable of rapid recolonization through larval recruitment following disturbance events, reaching former densities within a year (Arntz and Rumohr, 1986). The majority of the important characteristic species of the biotope can maintain the character of the biotope and recruit within the first two years after disturbance (De-Bastos and Watson, 2023). The majority of the characterising species in the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF are infaunal and will therefore be somewhat protected from surface level abrasion (e.g. such as that arising from jack-ups, anchor placements and cable installation). Based on their sedimentary habitat, the species associated with this IEF are capable of surviving light smothering events (De-Bastos and Watson, 2023). Furthermore, penetration such as that which might be experienced from jack-up vessels may cause some damage and mortality in the short term however based on the limited scale of this potential impact recovery is highly likely (De-Bastos and Watson, 2023).

2.9.2.14 The subtidal coarse and mixed sediments with diverse benthic communities IEF, which dominates the Morgan Array Area, has an overall medium sensitivity to temporary habitat loss/disturbance. The biotopes within this IEF generally have a low sensitivity to abrasion and penetration related disturbance because these habitats are largely characterised by infauna and although abrasion or penetration may result in damage or mortality to some epifaunal organisms' resilience is considered to be high (Tillin and Watson 2024a; Tillin and Watson 2023). Sensitivity to habitat structure change is generally considered to be medium. Sedimentary communities are likely to be intolerant of substratum removal, which will lead to partial or complete defaunation (Dernie *et al*., 2003). Recovery of the sedimentary habitat would occur via infilling, although some recovery of the biological assemblage may take place before the original topography is restored, if the exposed, underlying sediments are similar to those that were removed. Recovery of sediments will be site-specific following activities such as sandwave clearance and will be influenced by currents, wave action and sediment availability (Desprez, 2000). The sensitivity of this IEF to heavy smothering, such as that which might result from the deposition of sandwave clearance material, is considered to be low to medium as many of the bivalves and polychaete species in this IEF are able to migrate through depositions of sediment greater than the benchmark (30 cm of fine material added to the seabed in a single discrete event) (Bijkerk, 1988; Powilleit *et al*., 2009).

2.9.2.15 The seapens and burrowing megafauna communities IEF has an overall medium sensitivity to temporary habitat loss/disturbance (Table 2.19). In the MarESA the sensitivity to the removal of substratum is high as well as to penetration of the seabed as seapen burrows can be up to 25 to 40 cm deep therefore the extraction of the top 30 cm of sediment (the benchmark for this pressure) would result in the removal of any seapens present (Hill *et al.*, 2023). Seapens can avoid the effects of abrasive activities by retreating into their burrows but frequent disturbance will reduce feeding time. Some species of seapen (*Funiculina quadrangularis*) cannot withdraw in to burrows and would therefore be damaged by abrasive activities. The evidence of the effect of abrasion on *Halipteris willemoesi* in Alaskan waters suggests that seapens can recover from physical abrasion but that specimens that are dislodged or fractured are likely to die, especially in the presence of predators (Malecha and Stone, 2009). Due to their burrowing lifestyle seapens are unlikely to be sensitive to the effects of smothering and have been found to recover within 72 to 96 hours after experimental smothering by pots or creels for 24 hours (Kinnear *et al*., 1996), however smothering by fine sediment could clog feeding apparatus and exclude oxygen (Hill *et al*, 2023). Within the Morgan benthic subtidal ecology study area no seapens were observed as part of the site-specific survey, however they are not necessary to the allocation of this habitat (section 2.5 and Volume 4, Annex 2.1: Benthic subtidal ecology technical report of the Environmental Statement). Given that seapens are understood to be absent from the study area (section 2.5), 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).

2.9.2.16 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF is deemed to be of low to high vulnerability and low to medium recoverability. Based on assessments made by the MarESA, it is of overall not sensitive to medium sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance (Table 2.19). The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes 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 **medium**.

2.9.2.17 The subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of medium to very high vulnerability and medium to high recoverability. Based on assessments made by the MarESA, it is of overall low to medium sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance (Table 2.19). 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 2.19. The sensitivity of the receptor is considered to be **medium**.

2.9.2.18 The seapens and burrowing megafauna communities IEF is deemed to be of low to high vulnerability and low to high recoverability. Based on assessments made by the MarESA, it is of overall high sensitivity to the MarESA pressures associated with temporary habitat loss/disturbance (Table 2.19). 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 2.19. The sensitivity of the receptor is considered to be **high** (and reduced to **medium** in the absence of seapens).

Table 2.19: Sensitivity of the benthic subtidal IEFs to temporary subtidal habitat loss/disturbance

IEF	Representative biotopes	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 sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes	SS.SMu.CSaMu.LkorPpel	Medium	Medium	Medium	Not sensitive	Medium
Subtidal coarse and mixed sediments with diverse benthic communities	SS.SCS.CCS	Medium	Low	Low	Medium	Medium
	SS.SMx.OMx SS.SMx.OMx.PoVen	Medium	Low	Low	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)

Significance of the effect

2.9.2.19 Overall, for both the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF the magnitude of the temporary habitat disturbance/loss impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

2.9.2.20 Overall, for the seapens and burrowing megafauna communities IEF the magnitude of the temporary habitat disturbance/loss impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be high (and reduced to medium in the absence of seapens). The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Operations and maintenance phase

Magnitude of impact

2.9.2.21 Maintenance activities within the Morgan Array Area (i.e. jack-ups associated with maintenance at wind turbines and OSPs and cable repair/reburial events) will result in temporary habitat loss/disturbance. There may also be disturbance associated with the movement of anchor chains associated with buoys that may be deployed within the Morgan Array Area.

2.9.2.22 The MDS accounts for up to 11,362,800 m^2 of temporary habitat disturbance within this phase (Table 2.16). This equates to a small proportion (1.19%) of the Morgan benthic subtidal ecology study area. It should also be noted that only a small proportion of the total temporary habitat loss/disturbance is likely to occur at any one time over the 35 year operational lifetime.

2.9.2.23 The potential impacts of jack-up vessel activities will be similar to those identified for the construction phase and will be spatially restricted to the immediate area around the foundations, where the spud cans are placed on the seabed, with recovery occurring following removal of spud cans. The spatial extent of this potential impact is small in relation to the total Morgan benthic subtidal ecology study area, although there is the potential for repeat disturbance to the habitats in the immediate vicinity of the foundations because of these activities. Repeat disturbance may also result from the movement of anchor chains for buoys on the seabed as the buoys are likely to be present throughout the operations and maintenance phase, however this will only affect a small area in the immediate vicinity of a limited number of buoys. The repair and reburial of inter-array and OSP interconnector cables will also 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 (see paragraph 2.9.2.7).

2.9.2.24 The impact on the subtidal habitat IEFs in the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) is predicted to be of local spatial extent, short term duration (i.e. individual maintenance activities would likely occur over a period of days to weeks, over the 35 year operational lifetime of the Morgan Generation Assets), intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.

Sensitivity of receptor

2.9.2.25 The sensitivity of the relevant subtidal habitat IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF) is as described previously for the construction phase assessment in paragraph 2.9.2.12 to 2.9.2.15 and above in Table 2.19.

2.9.2.26 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

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

Significance of effect

2.9.2.28 Overall, for both the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediments with diverse benthic communities IEF the magnitude of the temporary habitat disturbance/loss impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor** significance, which is not significant in EIA terms. This conclusion has been reached based on the localised and intermittent nature of this potential impact in this phase of the Morgan Generation Assets as well as the small scale of the disturbance expected from operations and maintenance activities.

2.9.2.29 Overall, for the seapens and burrowing megafauna communities IEF the magnitude of the temporary habitat disturbance/loss impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be high (and reduced to medium in the absence of seapens). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms. This conclusion has been reached based on the localised and intermittent nature of this potential impact in this phase of the Morgan Generation Assets as well as the small scale of the disturbance expected from operations and maintenance activities.

Decommissioning phase

Magnitude of impact

2.9.2.30 The MDS for the decommissioning phase assumes that all foundations and cables will be removed and that the decommissioning sequence will generally be a reverse of the construction sequence. The MDS for decommissioning therefore assumes that temporary habitat disturbance may arise as a result of the removal of 390 km of inter-array cables and 60 km of interconnector cables as well as the use of jack-up vessels during the removal of foundations.

2.9.2.31 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 paragraph 2.9.2.4 to 2.9.2.11 (i.e. up to 61,422,400 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, however, likely to be lower than during construction.

2.9.2.32 The impact on the subtidal habitat IEFs in the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) is predicted to be of local 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**.

Sensitivity of receptor

2.9.2.33 The sensitivity of the relevant subtidal habitat IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF) is as described previously for the construction phase assessment in paragraph 2.9.2.12 to 2.9.2.15 and above in Table 2.19.

2.9.2.34 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

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

Significance of effect

2.9.2.36 Overall, for both the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediments with diverse benthic communities IEF the magnitude of the temporary habitat disturbance/loss impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

2.9.2.37 Overall, for the seapens and burrowing megafauna communities IEF the magnitude of the temporary habitat disturbance/loss impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high (and reduced to medium in the absence of seapens). The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

2.9.3 Increase in suspended sediment concentrations and associated deposition

2.9.3.1 Increases of SSCs and associated deposition are predicted to occur during the construction and decommissioning phases as a result of the installation/removal of foundations, sandwave clearance activities and the installation of inter-array and interconnector cables. Increases in suspended sediments and associated sediment deposition are also predicted to occur during the operations and maintenance phase due to inter-array and OSP interconnector cable repair and reburial events. Volume 4, Appendix 1.1: Physical processes technical report of the Environmental Statement provides a full description of the physical assessment, including numerical modelling used to inform the predictions made with respect to increases in suspended sediment and subsequent deposition.

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

- 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)
- 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.

2.9.3.3 These pressures correspond to the potential impacts associated with sandwave clearance, the installation of foundations for wind turbines and OSPs via drilling and the installation of cables (inter-array and interconnector) by trenching.

2.9.3.4 With regards to background SSCs, 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 are associated with large rivers such as those that discharge into the Thames Estuary, The Wash and Liverpool Bay, which show mean values of SPM above 30 mg/l. Based on the data provided within this study, the SPM associated with the Morgan Generation Assets has been estimated as approximately 0.9 mg/l to 3 mg/l over 1998 to 2005.

2.9.3.5 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 Morgan Array Area, whilst any debris will be taken ashore for disposal.

2.9.3.6 The subtidal IEFs that have the potential to be affected by increases in SSCs and associated deposition across all phases of the Morgan Generation Assets are those present within the Morgan Array Area and ZoI (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF, seapens and burrowing megafauna communities IEF, brittlestar beds IEF, and Annex I low resemblance stony reef (outside a SAC) IEF (see Table 2.18)).

2.9.3.7 The West of Walney MCZ IEFs that have the potential to be affected by increases in SSCs and associated deposition across all phases of the Morgan Generation Assets are the subtidal mud IEF, subtidal sand IEF and seapens and burrowing megafauna communities IEF (see Table 2.18).

2.9.3.8 The West of Copeland MCZ IEFs that have the potential to be affected by increases in SSCs and associated deposition across all phases of the Morgan Generation Assets are the subtidal coarse sediment IEF, subtidal mixed sediment IEF and subtidal sand IEF (see Table 2.18).

Construction phase

Magnitude of impact

Subtidal habitat IEFs

2.9.3.9 Full details of the modelling undertaken to inform this assessment including relevant figures are presented in Volume 4, appendix 1.1: Physical processes technical report of the Environmental Statement, including the individual scenarios considered and assumptions within these and full modelling outputs for suspended sediments and associated sediment deposition. For the purposes of this assessment, the following activities have been considered (see Table 2.16):

- Seabed preparation (sandwave, boulder and debris clearance)
- Drilling for foundation installation
- Installation of inter-array and interconnector cables.

2.9.3.10 For cable installation, sandwaves will be reduced in height in order to allow passage of the burial tool to enable cable burial to a sufficient target depth. As outlined in Table 2.16, seabed preparation activities may be undertaken using a range of techniques, but 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. In practice, plough dredging which 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 may be undertaken. However, the modelling simulated the use of a suction hopper dredger with a phasing representative of the scale of the sandwaves; dredging, and then depositing material within the cable corridor as it progressed along the route, resulting in higher quantification of sedimentation compared to the plough dredging. 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. At the site of gravity base foundations a proportion of the dredged volume removed to place the foundation will be used as ballast. This volume is less than the volume of the bed occupied by the installed foundation.

2.9.3.11 The dredging phase plumes, during sandwave clearance, are predicted to be smaller than the plumes generated during the dumping phase (<50 mg/l). The deposition plume is expected to be most extensive when the deposited material is redistributed on the successive tides, with average SSC levels of <500 mg/l above background levels, extending a tidal excursion circa 20 km from the site. During the dumping phase the plume is slightly larger with concentrations reaching 3,000 mg/l above background levels at the release site for the inter-array and interconnector cables, with the plume extending 5 km northeast of the dump site.

2.9.3.12 Average sedimentation associated with the sandwave clearance for inter-array and interconnector cables is expected to be up to 0.5 mm, with sedimentation extending the furthest west and east of the site approximately 10 km. One day following cessation of activities deposited material at the site of release is modelled to be 0.3 mm deep reducing to <0/01 mm at distances of 100 m from the release site. The dispersion of the released material is predicted to continue on successive tides.

2.9.3.13 It is proposed that a small proportion of the dredged material from site preparation, 7,000 m^3 per foundation, may be sequestered as ballast within the gravity base foundation with a maximum total volume of 490,000 m^3. Within the Morgan Array Area the seabed sediment is comprised largely of medium to coarse sand, and is therefore suited to augment with rock infill to provide ballast. This material typically represents a depth of *circa* 95cm below the slab foundation and scour protection extent and <8% of the seabed preparation volume. At the site of each of the largest wind turbine gravity base foundation an average of 41,337 m^3 of gravel may be placed to underlie the installation. Therefore, although the sequestered material will be removed from the sediment budget, the sediment in question represents a smaller volume than that occupied by the gravity base foundation within the seabed and the installation processes will not result in a void which could potentially interrupt transport processes by intercepting sediment.

2.9.3.14 As outlined in Table 2.16, the MDS for foundation installation assumes all wind turbine and OSP foundations will be installed by drilling a 16 m diameter monopile to a depth of 60 m at a rate of 0.73 m/h. A sample of three representative pile installation scenarios were simulated to cover the range of conditions in terms of water depth, tidal currents and sediment grading. At each location modelling assessed two piles being installed simultaneously. Modelling of suspended sediments (showed in Volume 2, Chapter 1: Physical processes of the Environmental Statement) associated with drilling for foundation installation in the northwest of the Morgan Array Area predicted average concentrations of <30 mg/l at the modelled site with the concentration reducing rapidly with distance from the two discharge locations. During drilling for foundation installation the sediment plume envelope in the northwest of the site is predicted to extend to a distance of approximately 6 km (i.e. 6 km to the southwest and 6 km to the northeast of the foundation installation site). Where the plumes converge concentrations of suspended sediment are <1 mg/l above background levels. In the northeast of the site the stronger currents and finer material means that a greater proportion of the material will be suspended. The peak concentrations for the installation and up to three days following installation in the northeast of the Morgan Array Area are approximately 50 mg/l and average values are typically less than one fifth of this magnitude. In the northeast, the maximum extent of the plume envelope is approximately 22 km (12 km to the southwest to 10 km to the northeast). In the southeast of the site average sediment concentrations are 50 mg/l where the plumes coalesce. The total maximum extent of this plume envelope is approximately 13 km (southwest to northeast). This is similar to the unmerged values as the plumes are travelling in concert with the tide (and not towards one another) and at the point that the plume reaches the adjacent discharge it is highly dispersed.

2.9.3.15 Within the Morgan Array Area, following foundation installation, sediment was expected to be deposited on the slack tide and then subsequently re-suspended into the water column. The plume concentration associated with this resuspension was <50 mg/l and reduces with the distance from the site as the sediment is dispersed. In the northeast of the Morgan Array Area material is also predicted to settle out on the slack tide and be re-suspended with increasing current speed. In the southeast of the Morgan Array Area at the centre of the plume envelope peak values are circa 50 mg/l. Three days after the cessation of foundation installation, sediment concentrations are reduced with decreased current speeds on slack tides and mobilise settled material as speed increase through the tidal cycle. Under these circumstances peak concentrations are 50 mg/l and average values are typically one tenth of this value, with the peaks centred on areas of remobilised material.

2.9.3.16 Following drilling in the northwest of the Morgan Array Area sedimentation depths are particularly low with sedimentation values of <0.1 mm during all phases of drilling at all the modelled sites. This corresponds with the immediate settlement of coarser material fractions, the lower neap current speed and also for the portion of work undertaken on slack tide. This settlement would be imperceptible from the background sediment transport activity.

2.9.3.17 For the inter-array cable installation, peak plume concentrations are 300 to 500 mg/l (at the release site) with the sediment settling during slack water becoming resuspended in the form of an amalgamated plume. Sedimentation of up to 50 mm is predicted at the trench site, with sediment depths reducing with increasing distance from the trench to <0.5 mm with the maximum extent of the plume from the cable installation site being 13 km. Plume envelopes of increased SSCs of between 0.13-300 mg/l are predicted to extend over a plume envelope of 33 km width in total, extending from the southwest to the northeast of the modelled installation pathway, and are associated with remobilisation of the deposited material on subsequent tides. Following the completion of the inter-array cable installation the turbidity levels will return to baseline within a couple of tidal cycles. Sedimentation depths of <30 mm arise beyond the immediate vicinity of the trench one day following the cessation of drilling and therefore would be indiscernible from the existing seabed.

2.9.3.18 The result of the modelling for the interconnector cables were similar to those for the inter-array cable. The plume is predicted to extend east and west on the tide as the release progresses along the route perpendicular to the tidal flow. This gives rise to average SSCs of <50 mg/l offshore. SSCs along the modelled installation route however range between 50 and 1,000 mg/l where the greatest levels are located at the source of the sediment release. The sedimentation level is small typically <0.5 mm and the greatest levels of deposition occur along the trenching route as coarser material settles. The re-mobilisation of deposited material on subsequent tides is predicted to result in plumes of increased sediment concentration extending 11 km northwest to southeast along the corridor of installation and 3.5 km on either side of the installation corridor.

2.9.3.19 The impact on the subtidal habitat IEFs in the Morgan benthic subtidal ecology study area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF, seapens and burrowing megafauna communities IEF, brittlestar beds IEF, and Annex I low resemblance stony reef (outside an SAC) IEF) is predicted to be of local spatial extent, short term duration (i.e. construction phase of up to four years, although at any one time only a small proportion of activities resulting in this impact will occur), intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **low**.

West of Walney MCZ

2.9.3.20 Construction activities will not occur within the West of Walney MCZ and so the designated features will not be directly affected. There is the potential during certain conditions, namely flood tides coupled with wind from the southwest, that during construction activities in the east of the Morgan Array Area, sediment plumes may extend to the west edge of the West of Walney MCZ. However, prior to reaching these locations, significant dispersion will have occurred with concentrations predicted to be well below 1 mg/l. The deposition arising from these very low SSCs is predicted to be *de minimis*. The effects of increased SSC and associated deposition on the West of Walney MCZ is also considered within the Morgan Generation Assets MCZ Screening Assessment.

2.9.3.21 The impact is predicted to be of local spatial extent, short term duration (i.e. construction phase of up to four years, although at any one time only a small proportion of activities resulting in this potential impact will occur), intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **negligible**.

West of Copeland MCZ

2.9.3.22 Construction activities will not occur within the West of Copeland MCZ and so the designated features will not be directly affected. There is the potential during certain conditions, namely flood tides coupled with wind from the southwest, that during construction activities in the east of the Morgan Array Area, sediment plumes may extend to the west edge of the south tip of the West of Copeland MCZ. However, prior to reaching these locations, significant dispersion will have occurred with concentrations predicted to be well below 1 mg/l. the deposition arising from these very low SSCs is predicted to be *de minimis*. The effects of increased SSC and associated deposition on the West of Copeland MCZ is also considered within the Morgan Generation Assets MCZ Screening Assessment.

2.9.3.23 The impact is predicted to be of local spatial extent, short term duration (i.e. construction phase of up to four years, although at any one time only a small proportion of activities resulting in this potential impact will occur), intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **negligible.**

Sensitivity of receptor

Subtidal habitat IEFs

2.9.3.24 Subtidal habitat IEFs which are expected to be affected by increases in SSC and associated deposition are listed in paragraph 2.9.3.6 and Table 2.18. The sensitivity of the subtidal IEFs to increases in SSC and associated deposition is presented in Table 2.20. These sensitivities are based on assessments made by the MarESA.

2.9.3.25 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF has an overall low sensitivity to the pressures associated with this impact (Table 2.20) due to the infaunal nature of these communities and their natural sedimentary environment which enables them to adapt. Changes in SSC and deposition can occur naturally in these habitats as a result of changes in hydrodynamics (De-Bastos and Watson, 2023). 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 and Watson, 2023). 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 and Watson, 2023). Furthermore, the characterising species *Lagis koreni, Abra alba* and *Phaxas pellucidus* are likely to be able to burrow through light smothering events, although sudden smothering would temporarily halt feeding and respiration. However, the increase in suspended sediments associated with the construction phase is likely to be intermittent and will dissipate quickly and the biotope is likely to resist smothering at the benchmark level.

2.9.3.26 The subtidal coarse and mixed sediments with diverse benthic communities IEF has an overall low sensitivity to the pressures associated with this potential impact (Table 2.20). The subtidal coarse and mixed sediments with diverse benthic communities IEF is representative of biotopes which are characterised by their sedimentary substrate. 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 to 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 and Watson, 2023), 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 and Watson, 2023).

2.9.3.27 The seapens and burrowing megafauna communities IEF has an overall negligible sensitivity to increases in SSC and associated deposition (Table 2.20). 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 *Virgularia 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 Morgan benthic subtidal ecology study area (section 2.5). Similarly, burrowing megafauna are unlikely to be affected adversely by changes in suspended sediment in the water column. *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.

2.9.3.28 The brittlestar beds IEF has an overall medium sensitivity to increases in SSC and associated deposition (Table 2.20). 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).

2.9.3.29 The Annex I low resemblance stony reef (outside an SAC) IEF has an overall negligible sensitivity to increases in SSC and associated deposition (see Table 2.20). 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.

2.9.3.30 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

2.9.3.31 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.**

2.9.3.32 The Annex I low resemblance stony reef (outside an SAC) IEF and the seapens and burrowing megafauna communities IEF are not deemed to be sensitive and are of national value. The sensitivity of the receptor is therefore, considered to be **negligible.**

West of Walney MCZ

2.9.3.33 The sensitivities of the subtidal mud IEF, subtidal sand IEF and seapens and burrowing megafauna IEF within the West of Walney MCZ are summarised in Table 2.20.

2.9.3.34 The subtidal mud IEF and subtidal sand IEF within the West of Walney MCZ both have an overall negligible sensitivity to increases in SSC and associated deposition. The subtidal mud IEF and subtidal sand IEF 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). This biotope has a similar sensitivity to the pressures from increases in suspended sediments and deposition as the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF described in paragraph 2.9.3.24 (see also Table 2.20). 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 *Amphiura filiformis*, and bivalves *Kurtiella bidentata* (De-Bastos, Hill and Garrard, 2023). 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, Hill and Garrard, 2023; De-Bastos, Marshall and Watson, 2023). Polychaetes such as *Nephtys* and *Nereis* have been reported as tolerate of up to 50 cm of mud and up to 80 cm of sand (Essink, 1999). The subtidal sand biotope is also represented by the SS.SMx.CMx.KurThyMx biotope which has been assessed by the MarESA as being insensitive to the pressures associated with increases in SSC and the associated deposition. This conclusion has been reached based on *Kurtiella bidentata* being regularly found in high turbidity environments and *Thyasira flexuosa* are buried within the sediment and are fed by symbiotic bacteria they are considered insensitive to a change in suspended solids (De-Bastos, Marshall and Watson, 2023).

2.9.3.35 The sensitivity of the seapens and burrowing megafauna communities IEF within the West of Walney MCZ is as described for this subtidal habitat IEF in paragraph 2.9.3.27.

2.9.3.36 The seapens and burrowing megafauna communities IEF and subtidal mud IEF and subtidal sand IEF within the West of Walney MCZ are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore, considered to be **negligible.**

West of Copeland MCZ

2.9.3.37 The sensitivities of the subtidal coarse sediment IEF and subtidal mixed sediment IEF within the West of Copeland MCZ is as described for the subtidal coarse and mixed sediments with diverse benthic communities IEF in (Table 2.20).

2.9.3.38 The sensitivity of the subtidal sand IEF is as described previously for the subtidal sand IEF in the West of Walney MCZ in paragraph 2.9.3.33.

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

2.9.3.40 The subtidal sand IEF is deemed not to be sensitive and of national value. The sensitivity of the receptor is therefore, considered to be **negligible.**

Table 2.20: Sensitivity of all of the relevant IEFs to increased SSC and associated sediment deposition.

IEF	Representative biotopes	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 sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	Not sensitive	Low
	SS.SMu.CSaMu.LkorPpel	Not sensitive	Not sensitive	
	SS.SSa.CMuSa SS.SSa.CFiSa.EpusOborApri	Low	Low	
Subtidal coarse and mixed sediments with diverse benthic communities	SS.SCS.CCS	Low	Low	Low
	SS.SMx.OMx SS.SMx.OMx.PoVen	Low	Low	
Brittlestar beds	SS.SMx.CMx.OphMx	Not sensitive	Medium	Medium
Annex I low resemblance stony reef (outside an SAC)	CR.HCR.XFa.SpNemAdia.	Not sensitive	Not sensitive	Negligible
Seapens and burrowing megafauna communities	SS.SMu.CFiMu.SpnMeg	Not sensitive	Not sensitive	Negligible
West of Walney MCZ				
Subtidal mud	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	Not sensitive	Negligible
Subtidal sand	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	Not sensitive	Negligible
	SS.SMx.CMx.KurThyMx	Not sensitive	Not sensitive	
Seapens and burrowing megafauna communities	SS.SMu.CFiMu.SpnMeg	Not sensitive	Not sensitive	Negligible

IEF	Representative biotopes	Sensitivity to defined MarESA pressure		Overall sensitivity (based on Table 2.14)
		Changes in suspended solids (water clarity)	Smothering and siltation rate changes (light)	
West of Copeland MCZ				
Subtidal coarse sediment	SS.SCS.CCS	Low	Low	Low
Subtidal mixed sediment	SS.SMx.OMx SS.SMx.OMx.PoVen	Low	Low	Low
Subtidal sand	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	Not sensitive	Negligible

Significance of effect

Subtidal Habitat IEFs

2.9.3.41 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediment with diverse benthic communities IEF the magnitude of the increase in suspended sediments and associated deposition impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the intermittent and low magnitude of the impact together with the ability of these habitats to recover from the relevant pressures.

2.9.3.42 Overall, for the brittlestar beds IEF the magnitude of the increase in suspended sediments and associated deposition impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor** significance, which is not significant in EIA terms.

2.9.3.43 Overall, for the Annex I low resemblance stony reef (outside an SAC) IEF and the seapens and burrowing megafauna communities IEF the magnitude of the increase in suspended sediments and associated deposition impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the intermittent and low magnitude of the impact together with the ability of these habitats to recover from the relevant pressures.

West of Walney MCZ

2.9.3.44 Overall, for the subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF within the West of Walney MCZ the magnitude of the increase in suspended sediments and associated deposition impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

West of Copeland MCZ

2.9.3.45 Overall, for the subtidal coarse sediment IEF and subtidal mixed sediment IEF within the West of Copeland MCZ the magnitude of the increase in suspended sediments and associated deposition impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the distance of the MCZ from the Morgan Generation Assets and the very low levels of suspended sediment and deposition associated with the activities in this phase of the Morgan Generation Assets that are likely to reach the MCZ.

2.9.3.46 Overall, for the subtidal sand IEF within the West of Copeland MCZ the magnitude of the increase in suspended sediments and associated deposition impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

Operations and maintenance phase

Magnitude of impact

Subtidal habitat IEFs

2.9.3.47 Maintenance activities within the Morgan Array Area may lead to increases in SSCs and associated sediment deposition over the operational lifetime of the Morgan Generation Assets. The MDS, as outlined in Table 2.16, includes the repair of 8 km of inter-array cable in one event every three years, the reburial of 20 km of inter-array cable in one event every five years, the repair of 20 km of interconnector cable in three events every 10 years and the reburial of 3 km of interconnector cable with one event every five years.

2.9.3.48 In each case the length of the repair or reburial activity may be up to 20 km; therefore, the magnitude of this potential impact would be a fraction of what is predicted to occur during the construction phase (Volume 2, Chapter 1: Physical processes of the Environmental Statement). The sediment plumes and sedimentation footprints would be dependent on which section of the cable is being repaired however the entire length has been quantified under the construction phase scenario (Table 2.16).

2.9.3.49 The removal of encrusted growth from offshore structures may also occur during the operations and maintenance phase however no quantitative assessment can be made as the volume of encrusting material that may be removed is not known. An investigation conducted at the research platform Forschungsplattformen in Nord- und Ostsee 1 FINO 1 in the southwest German Bight in the North Sea reported that yearly, 878,000 single shell halves from *M. edulis* sink onto the seabed from the FINO 1 platform, thereby greatly extending the reef effects created by the construction of the offshore platform structure (Krone *et al*., 2013). Although recent monitoring from Beatrice offshore wind farm found no *M. edulis* colonised its structures reducing the amount of debris reaching the seabed (APEM, 2021).

2.9.3.50 Removal of marine growth from the wind turbine foundations may cause debris to fall within the vicinity of the wind turbine foundation and smother benthic communities within the potential impact zone. It is likely that seaweed/algal material would disperse into the water column, with heavier material (e.g. mussels) being deposited within 10m to 15m of the foundation (Vattenfall Wind Power Ltd, 2018). The discharge of the fine material generated as a result of the use of high- pressure jet washing to remove the encrusting fauna into the marine environment may result in a short-term increase in suspended organic material in the water column. This material would be expected to be rapidly dispersed on the following tides and under the prevailing hydrodynamic conditions. The study by Mavraki *et al*. (2020) of gravity-based foundations in the Belgian part of the North Sea found that higher food web complexity was associated with zones where high accumulation of organic material such as soft substrate or scour protection which begins to describe the potential reef effect that can be found at these hard structures and is considered further in section 2.9.5.18.

2.9.3.51 The impact on the subtidal habitat IEFs in the Morgan benthic subtidal ecology study area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF, seapens and burrowing megafauna communities IEF, brittlestar beds IEF, and Annex I low resemblance stony reef (outside an SAC) IEF) is predicted to be of local spatial extent, short term duration, intermittent and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **negligible**.

West of Walney MCZ

2.9.3.52 The magnitude of the increase in suspended sediment and associated deposition within the West of Walney MCZ is likely to be a fraction of that described for the subtidal habitat IEFs in paragraphs 2.9.3.47 and 2.9.3.50. The West of Walney MCZ is located 9.3 km from the Morgan Generation Assets and whilst there may be some impact from SSCs in the operations and maintenance phase is predicted to be *de minimis*, the magnitude would be considerably smaller than that predicted during the construction phase. The effects of increased SSC and associated deposition on the West of Walney MCZ is also considered within the Morgan Generation Assets MCZ Screening Assessment.

2.9.3.53 The impact is predicted to be of local spatial extent, short term duration, intermittent and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **negligible**.

West of Copeland MCZ

2.9.3.54 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 2.9.3.47 and 2.9.3.50. The West of Copeland MCZ is located 8.8 km from the Morgan Generation Assets and whilst there may be some impact from SSCs in the operations and maintenance phase is predicted to be *de minimis*, the magnitude would be considerably smaller than that predicted during the construction phase. The effects of increased SSC and associated deposition on the West of Copeland MCZ is also considered within the Morgan Generation Assets MCZ Screening Assessment.

2.9.3.55 The impact is predicted to be of local spatial extent, short term duration, intermittent and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **negligible**.

Sensitivity of receptor

Subtidal habitat IEFs

2.9.3.56 The sensitivity of the subtidal habitat IEFs (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF, seapens and burrowing megafauna communities IEF, brittlestar beds IEF, and Annex I low resemblance stony reef (outside an SAC) IEF) is as described previously for the construction phase assessment in paragraph 2.9.3.24 to 2.9.3.30 and above in Table 2.19.

2.9.3.57 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore considered to be **low**.

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

2.9.3.59 The Annex I low resemblance stony reef (outside an SAC) IEF and the seapens and burrowing megafauna communities IEF are deemed not to be sensitive and of national value. The sensitivity of the receptor is therefore considered to be **negligible.**

West of Walney MCZ

2.9.3.60 The sensitivity of the West of Walney MCZ IEFs (i.e. seapens and burrowing megafauna communities IEF and subtidal mud IEF and subtidal sand IEF) is as described previously for the construction phase assessment in paragraph 2.9.3.33 to 2.9.3.36 and above in Table 2.19.

2.9.3.61 The seapens and burrowing megafauna communities IEF and subtidal mud IEF and subtidal sand IEF within the West of Walney MCZ are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible.**

West of Copeland MCZ

2.9.3.62 The sensitivity of the West of Copeland MCZ IEFs (i.e. subtidal coarse sediment IEF, subtidal mixed sediment IEF and subtidal sand IEF) is as described previously for the construction phase assessment in paragraph 2.9.3.37 to 2.9.3.39 and above in Table 2.20.

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

2.9.3.64 The subtidal sand IEF within the West of Copeland MCZ is deemed not to be sensitive and of national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

Significance of effect

Subtidal habitat IEFs

2.9.3.65 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediment with diverse benthic communities IEF the magnitude of the increase in SSC and associated deposition impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the low levels of SSC and deposition associated with the activities in this phase of the Morgan Generation Assets and the ability of the communities to recover.

2.9.3.66 Overall, for the brittlestar beds IEF the magnitude of the increase in SSC and associated deposition impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the low levels of SSC and deposition associated with the activities in this phase of the Morgan Generation Assets and the ability of the communities to recover under normal flow rates.

2.9.3.67 Overall, for the low resemblance stony reef IEF and the seapens and burrowing megafauna communities IEF the magnitude of the increase in SSC and associated deposition impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

West of Walney MCZ

2.9.3.68 Overall, for the subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF within the West of Walney MCZ the magnitude of the increase in SSC and associated deposition impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the distance of the MCZ from the Morgan Array Area and the very low levels of SSC and deposition associated with the activities in this phase of the Morgan Generation Assets that are likely to reach the MCZ.

West of Copeland MCZ

2.9.3.69 Overall, for the subtidal coarse sediment IEF and the subtidal mixed sediment IEF within the West of Copeland MCZ the magnitude of the increase in SSC and associated deposition impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the distance of the MCZ from the Morgan Array Area and the very low levels of SSC and deposition associated with the activities in this phase of the Morgan Generation Assets that are likely to reach the MCZ.

2.9.3.70 Overall, for the subtidal sand IEF within the West of Copeland MCZ the magnitude of the increase in SSC and associated deposition impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

Decommissioning phase

Magnitude of impact

Subtidal habitat IEFs

2.9.3.71 Decommissioning of the Morgan Generation Assets infrastructure may lead to increases in SSCs and associated sediment deposition. The MDS assumes that suction caisson foundations would be removed as well as inter-array and interconnector cables, and this would result in an increase is SSCs.

2.9.3.72 During decommissioning, increases in SSC and potential impacts would be of lesser magnitude than both the construction phase and the operations and maintenance phase with scour and cable protection remaining *in situ*. In the case of piled foundations, there is no significant disturbance of the seabed during decommissioning as piles are cut off.

2.9.3.73 Decommissioning of gravity bases would involve the removal of ballast, including sand sequestered during construction. This material, which may also include rock will be disposed of off-site and therefore a small proportion of sediment may be released during the removal/process; noting the ballast material derived from offsite sources would be tested for contamination prior to use. As per the MDS (Table 2.16), SSC would also increase temporarily if suction caissons were removed using overpressure to release. The increase in suspended sediments and the potential impact on physical features may persist during decommissioning, however they are localised in nature.

2.9.3.74 Increases in SSC due to the removal of inter-array and interconnector would be similar to those experienced during the construction phase, as retrieval would be undertaken using similar techniques to installation. As per the MDS (Table 2.16), SSC would increase temporarily if suction bucket jacket foundations were removed using overpressure to release. Increases in SSC due to the removal of inter-array and interconnector cables would be similar to those experienced during the construction phase, as retrieval would be undertaken using similar techniques to installation. The increase in SSC and the potential impact on benthic features may persist during decommissioning, however they would be localised in nature.

2.9.3.75 The impact on the subtidal habitat IEFs in the Morgan benthic subtidal ecology study area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF, seapens and burrowing megafauna communities IEF, brittlestar beds IEF, and Annex I low resemblance stony reef (outside an SAC) IEF) 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**.

West of Walney MCZ

2.9.3.76 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 2.9.3.71 and 2.9.3.72. The West of Walney MCZ is located 9.3 km from the Morgan Generation Assets and whilst there may be some impact from SSCs in the decommissioning phase is predicted to be *de minimis*, the magnitude would be considerably smaller than that predicted during the construction phase. The effects of increased SSC and associated deposition on the West of Walney MCZ is also considered within the Morgan Generation Assets MCZ Screening Assessment.

2.9.3.77 The impact 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**.

West of Copeland MCZ

2.9.3.78 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 2.9.3.71 and 2.9.3.72. The West of Copeland MCZ is located 8.8 km from the Morgan Generation Assets and whilst there may be some impact from SSCs in the decommissioning phase is predicted to be *de minimis*, the magnitude would be considerably smaller than that predicted during the construction phase. The effects of increased SSC and associated deposition on the West of Copeland MCZ is also considered within the Morgan Generation Assets MCZ Screening Assessment.

2.9.3.79 The impact 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**.

Sensitivity of receptor

Subtidal habitat IEFs

2.9.3.80 The sensitivity of the subtidal habitat IEFs (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF, seapens and burrowing megafauna communities IEF, brittlestar beds IEF, and Annex I low resemblance stony reef (outside an SAC) IEF) is as described previously for the construction phase assessment in paragraph 2.9.3.24 to 2.9.3.30 and above in Table 2.19.

2.9.3.81 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

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

2.9.3.83 The Annex I low resemblance stony reef (outside an SAC) IEF and seapens and burrowing megafauna communities IEF are deemed not to be sensitive and be of national value. The sensitivity of the receptor is therefore, considered to be **negligible.**

West of Walney MCZ

2.9.3.84 The sensitivity of the West of Walney MCZ IEFs (i.e. seapens and burrowing megafauna communities IEF and subtidal mud IEF and subtidal sand IEF) is as described previously for the construction phase assessment in paragraph 2.9.3.33 to 2.9.3.36 and above in Table 2.19.

2.9.3.85 The seapens and burrowing megafauna communities IEF and subtidal mud IEF and subtidal sand IEF within the West of Walney MCZ are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore, considered to be **negligible.**

West of Copeland MCZ

2.9.3.86 The sensitivity of the West of Copeland MCZ IEFs (i.e. subtidal coarse sediment IEF, subtidal mixed sediment IEF and subtidal sand IEF) is as described previously for the construction phase assessment in paragraph 2.9.3.37 to 2.9.3.39 and above in Table 2.20.

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

2.9.3.88 The subtidal sand IEF within the West of Copeland MCZ are deemed not to be sensitive and of national value. The sensitivity of the receptor is therefore, considered to be **negligible**.

Significance of effect

Subtidal habitat IEFs

2.9.3.89 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediments with diverse benthic communities IEF the magnitude of the increase in SSC and associated deposition impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the low levels of SSC and deposition associated with the activities in this phase of the project and the ability of these habitats to recover.

2.9.3.90 Overall, for the brittlestar beds IEF the magnitude of the increase in SSC and associated deposition impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the low levels of SSC and deposition associated with the activities in this phase of the project and the ability of these habitats to recover under normal flow rates.

2.9.3.91 Overall, for the Annex I low resemblance stony reef (outside an SAC) IEF and seapens and burrowing megafauna communities IEF the magnitude of the increase in SSC and associated deposition impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

West of Walney MCZ

2.9.3.92 Overall, for the subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF within the West of Walney MCZ the magnitude of the increase in SSC and associated deposition impact decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the low levels of SSC and deposition associated with the activities in this phase of the project and the distance of this MCZ from these activities.

West of Copeland MCZ

2.9.3.93 Overall, for the subtidal coarse sediment IEF and the subtidal mixed sediment IEF within the West of Copeland MCZ the magnitude of the increase in SSC and associated deposition impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the low levels of SSC and deposition associated with the activities in this phase of the project and the distance of this MCZ from these activities.

2.9.3.94 Overall, for the subtidal sand IEF within the West of Copeland MCZ the magnitude of the increase in SSC and associated deposition impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

2.9.4 Disturbance/remobilisation of sediment-bound contaminants

2.9.4.1 During activities such as sandwave clearance, cable and foundation 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.

2.9.4.2 The relevant MarESA pressures and benchmarks used to inform this impact assessment are described here:

- 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.

2.9.4.3 These pressures are relevant to the installation of foundations via drilling, cable installation and seabed preparation activities.

2.9.4.4 The subtidal IEFs with the greatest potential to be affected by disturbance/remobilisation of sediment-bound contaminants in the construction and decommissioning phases of the Morgan Generation Assets are those present within the Morgan Array Area and which may be subject to sediment disturbance (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF (see Table 2.18)).

Construction phase

Magnitude of impact

Subtidal habitat IEFs

2.9.4.5 The results of the sediment chemistry analysis for the Morgan Array Area are presented in section 2.5.3.1. The full results of this sediment chemistry analysis are detailed in Volume 4, Annex 2.1: Benthic ecology technical report of the Environmental Statement. The concentrations of the heavy metals, PAHs and PCBs were compared to the corresponding Cefas AL1 and AL2 and the Canadian TEL and PEL. The National Oceanic and Atmospheric Administration’s ERL and ERM thresholds were also used for PAHs only. Overall, levels of contamination were low across the Morgan benthic subtidal ecology study area. Concentrations of most metals were below the Cefas AL1 and the Canadian TEL and all were below the Cefas AL2 and Canadian PEL. The exception was arsenic which exceeded Cefas AL1 at three sample stations however all were below Cefas AL2, and 17 sample stations exceeded Canadian TEL but were below Canadian PEL. No samples were found to exceed the relevant thresholds for PCBs or PAHs in the Morgan benthic subtidal ecology study area. Concentrations of organotins where below the LOD at all stations.

2.9.4.6 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 Morgan Array Area as well as occurring intermittently over the construction phase. The MDS is for 18,236,920 m^3 of spoil from sandwave clearance, up to 2,107 m^3 of spoil volume per pile for drilling of wind turbine and OSP foundations (equating to total spoils volumes of up to 145,383 m^3 and 37,926 m^3 respectively) and spoil from cable installation (Table 2.16).

2.9.4.7 Following disturbance during construction activities, the majority of re-suspended sediments are expected to be deposited in the immediate vicinity of the works (as described in detail in section 2.9.3). 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.

2.9.4.8 The impact on the subtidal habitat IEFs in the Morgan benthic subtidal ecology study area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF, seapens and burrowing megafauna communities IEF, brittlestar beds IEF, and Annex I low resemblance stony reef (outside an SAC) IEF) is predicted to be of local spatial extent, short term duration, intermittent and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

West of Walney MCZ

2.9.4.9 As discussed in paragraph 2.9.4.5, 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 2.9.4.5 and 2.9.4.8. The West of Walney MCZ is located 9.3 km from the Morgan Generation Assets and, as discussed in paragraph 2.9.3.20, whilst sediment plumes may extend to the west edge of the south tip of the West of Walney MCZ, prior to reaching these locations, significant dispersion will have occurred. Concentrations at the West of Walney MCZ are predicted to be well below 1 mg/l. Any remobilised sediment-bound contaminants are predicted to have also been subject to significant dispersion and dilution. The effects of increased SSC and associated deposition on the West of Walney MCZ is also considered within the Morgan Generation Assets MCZ Screening Assessment.

2.9.4.10 The impact is predicted to be of local spatial extent, short term duration, intermittent and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **negligible**.

West of Copeland MCZ

2.9.4.11 As discussed in paragraph 2.9.4.5, 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 2.9.4.5 and 2.9.4.8. The West of Copeland MCZ is located 8.8 km from the Morgan Generation Assets, as discussed in paragraph 2.9.3.22, whilst sediment plumes may extend to the west edge of the south tip of the West of Copeland MCZ, prior to reaching these locations, significant dispersion will have occurred. Concentrations at the West of Copeland MCZ are predicted to be well below 1 mg/l. Any remobilised sediment-bound contaminants are predicted to have also been subject to significant dispersion and dilution. The effects of increased SSC and associated deposition on the West of Copeland MCZ is also considered within the Morgan Generation Assets MCZ Screening Assessment.

2.9.4.12 The impact is predicted to be of local spatial extent, short term duration, intermittent and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **negligible**.

Sensitivity of receptor

Subtidal habitat IEFs

2.9.4.13 Subtidal habitat IEFs which are expected to be affected by disturbance/remobilisation of sediment bound contaminants are listed in paragraph 2.9.4.4 and Table 2.18. These sensitivities are based on assessments made by the MarESA.

2.9.4.14 The disturbance/remobilisation of sediment-bound contaminants has the potential to affect all the subtidal IEFs and the sensitivity has overall been assessed to be low. Whilst the representative biotopes for the subtidal coarse and mixed sediments with diverse benthic communities IEF and subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF are not assessed by 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. For example, the capacity of bivalves to accumulate heavy metals in their tissues, far in excess of environmental levels, is well known, resulting in sub-lethal effects (Aberkali and Trueman, 1985). Echinoderms are also regarded as being intolerant of heavy metals (e.g. Bryan, 1984; Kinne, 1984) while polychaetes are generally tolerant (Bryan, 1984). 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 only heavy metal present at elevated levels within the subtidal area of the Morgan Generation Assets is arsenic (three stations exceeded Cefas AL1 however all stations were well below Cefas AL2. The benthic communities in this area have likely developed in an environment of existing elevated levels of arsenic and are therefore likely to have some tolerance to the absorption of arsenic. An increase in the concentration of arsenic in the seawater as a result of 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 effect the benthic communities present.

2.9.4.15 The seapens and burrowing megafauna communities IEF is assessed to have a low sensitivity to the disturbance/remobilisation of sediment-bound contaminants impact. The seapens and burrowing megafauna communities IEF has a high sensitivity to transition metals, hydrocarbons (PCBs) and PAHs however this is primarily based on evidence which focusses on Actinaria and corals rather than seapens directly. For example Reichelt-Brushett and Michalek-Wagner (2005) reported a decrease in fertilisation success in the octocoral *Lobophytum compactum* following exposure to copper exposure. Furthermore, evidence of the effects of the Deep Water Horizon spill on octocorals suggests that seapens, even at depth could be affected by an oil spill (Hill *et al*., 2023). The site-specific surveys however did not identify seapens at any of the stations sampled within the Morgan benthic subtidal ecology study area, therefore the sensitivity of this habitat to re-mobilised contaminants will be reduced.

2.9.4.16 The subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF are 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

2.9.4.17 The potential impacts on the subtidal sand IEF and subtidal mud IEF within the West of Walney MCZ are likely to be negligible due to the nature of the contamination. The benthic communities in this area have likely developed in an environment of existing contamination, so any release of contaminants from construction activities is not likely to significantly increase bioavailability. These IEFs are predominantly characterised by infaunal communities composed of polychaetes, Experimental studies with various species suggest that polychaete worms are quite tolerant of heavy metals (Bryan, 1984). Bryan (1984) also reports that early work has shown that echinoderm larvae are intolerant of heavy metals whereas adults are more resistant. The low levels of contamination however in this area as well as the short-term nature of this disturbance are unlikely to result in pervasive negative impacts.

2.9.4.18 The sensitivity of the seapens and burrowing megafauna communities IEF within the West of Walney MCZ is as described for this subtidal habitat IEF in paragraph 2.9.4.15.

2.9.4.19 The seapens and burrowing megafauna communities IEF, subtidal sand IEF and subtidal mud IEF within the West of Walney MCZ are deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

West of Copeland MCZ

2.9.4.20 Within the West of Copeland MCZ the potential impact to the subtidal coarse sediment IEF and mixed sediment IEF will be the same as described in paragraph 2.9.4.14 for the subtidal habitat IEFs.

2.9.4.21 The impact on the subtidal sand IEF will be the same as described in paragraph 2.9.4.17, for the same IEF in the West of Walney MCZ.

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

Significance of effect

Subtidal habitat IEFs

2.9.4.23 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the seapens and burrowing megafauna communities IEF the magnitude of the disturbance/remobilisation of sediment-bound contaminants impact during the construction phase of the Morgan Generation Assets is deemed to be negligible and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the very low levels of contamination in sediments in the Morgan Array Area.

West of Walney MCZ

2.9.4.24 Overall, for the subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF the magnitude of the disturbance/remobilisation of sediment-bound contaminants impact during the construction phase of the Morgan Generation Assets is deemed to be negligible and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the very low levels of contamination in sediments in the Morgan Array Area.

West of Copeland MCZ

2.9.4.25 Overall, for the subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the disturbance/remobilisation of sediment-bound contaminants impact during all phases of the Morgan Generation Assets is deemed to be negligible and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the very low levels of contamination in sediments in the Morgan Array Area.

Decommissioning phase

Magnitude of impact

Subtidal habitat IEFs

2.9.4.26 In the decommissioning phase of the Morgan Generation Assets there is potential for the remobilisation of sediment bound contaminants due to sediment disturbance arising from the removal of cables and suction bucket foundations for wind turbines and OSPs, if they are removed using the overpressure to release. During these activities, SSCs may be temporarily increased.

2.9.4.27 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 Morgan Array Area at the same concentrations in the decommissioning phase. Therefore the magnitude of this potential impact will be similar to the construction phase as presented in paragraphs 2.9.4.5 and 2.9.4.6.

2.9.4.28 As in the construction phase the majority of sediments resuspended during decommissioning activities are expected to be deposited in the immediate vicinity of the works (for further detail on deposition see section 2.9.3). 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.

2.9.4.29 The impact on the subtidal habitat IEFs in the Morgan benthic subtidal ecology study area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF, seapens and burrowing megafauna communities IEF, brittlestar beds IEF, and Annex I low resemblance stony reef (outside an SAC) IEF) is predicted to be of local spatial extent, short term duration, intermittent and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

West of Walney MCZ

2.9.4.30 As discussed in paragraph 2.9.4.5, 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 2.9.3.35 and 2.9.3.39. The West of Walney MCZ is located 9.3 km from the Morgan Generation Assets and, as discussed in paragraph 2.9.3.72, SSC in the decommissioning phase will be similar to the construction phase where whilst sediment plumes may extend to the west edge of the south tip of the West of Walney MCZ. Prior to reaching these locations, significant dispersion will have occurred. Concentrations at the West of Walney MCZ are predicted to be well below 1 mg/l. Any remobilised sediment-bound contaminants are predicted to have also been subject to significant dispersion and dilution. The effects of increased SSC and associated deposition on the West of Walney MCZ is also considered within the Morgan Generation Assets MCZ Screening Assessment.

2.9.4.31 The impact is predicted to be of local spatial extent, short term duration, intermittent and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **negligible**.

West of Copeland MCZ

2.9.4.32 As discussed in paragraph 2.9.4.5, 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 2.9.4.20 and 2.9.4.21. The West of Copeland MCZ is located 8.8 km from the Morgan Generation Assets and, as discussed in paragraph 2.9.3.72, SSC in the decommissioning phase will be similar to the construction phase where whilst sediment plumes may extend to the west edge of the south tip of the West of Copeland MCZ. Prior to reaching these locations, significant dispersion will have occurred. Concentrations at the West of Copeland MCZ are predicted to be well below 1 mg/l. Any remobilised sediment-bound contaminants are predicted to have also been subject to significant dispersion and dilution. The effects of increased SSC and associated deposition on the West of Copeland MCZ is also considered within the Morgan Generation Assets MCZ Screening Assessment.

2.9.4.33 The impact is predicted to be of local spatial extent, short term duration, intermittent and of high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **negligible**.

Sensitivity of receptor

Subtidal habitat IEFs

2.9.4.34 The sensitivity of the relevant subtidal habitat IEFs (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) is as described previously for the construction phase assessment in paragraph 2.9.4.14 to 2.9.4.16.

2.9.4.35 The subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the seapens and burrowing megafauna communities IEF are 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

2.9.4.36 The sensitivity of the West of Walney MCZ IEFs (i.e. seapens and burrowing megafauna communities IEF, subtidal sand IEF and subtidal mud IEF) is as described previously for the construction phase assessment in paragraph 2.9.4.17 to 2.9.4.18.

2.9.4.37 The seapens and burrowing megafauna communities IEF, subtidal sand IEF and subtidal mud IEF within the West of Walney MCZ are deemed to be of low vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **low**.

West of Copeland MCZ

2.9.4.38 The sensitivity of the West of Copeland MCZ IEFs (i.e. subtidal mixed sediment IEF, subtidal sand IEF and subtidal coarse sediment IEF) is as described previously for the construction phase assessment in paragraph 2.9.4.20 to 2.9.4.22.

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

Significance of effect

Subtidal habitat IEFs

2.9.4.40 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the seapens and burrowing megafauna communities IEF the magnitude of the disturbance/remobilisation of sediment-bound contaminants impact during the decommissioning phase of the Morgan Generation Assets is deemed to be negligible and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the very low levels of contamination in sediments in the Morgan Array Area.

West of Walney MCZ

2.9.4.41 Overall, for the subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF the magnitude of the disturbance/remobilisation of sediment-bound contaminants impact during the decommissioning phase of the Morgan Generation Assets is deemed to be negligible and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the very low levels of contamination in sediments in the Morgan Array Area.

West of Copeland MCZ

2.9.4.42 Overall, for the subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the disturbance/remobilisation of sediment-bound contaminants impact during all phases of the Morgan Generation Assets is deemed to be negligible and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the very low levels of contamination in sediments in the Morgan Array Area.

2.9.5 Long term habitat loss/habitat alteration

2.9.5.1 Long term subtidal habitat loss/habitat alteration within the Morgan Generation Assets will begin during the construction phase as infrastructure is gradually installed and will continue during the operations and maintenance phase when infrastructure is operational (Table 2.16). Long term habitat loss will occur directly under all wind turbine and OSP foundation structures (suction bucket jacket foundations for all structures). The installation of scour protection and cable protection (including at cable crossings), where this is required, will also lead to habitat alteration and a physical change to another seabed type under the scour/cable protection material. There may also be some small and localised long term habitat loss associated with the mooring systems (e.g. gravity based anchors) associated with the buoys which may be deployed within the Morgan Array Area (including light buoys, marker buoys, LiDAR buoys, waverider buoys, noise monitoring buoys, wave measurement buoys and mooring buoys). Magnitude has been considered for both phases combined as the structures will be placed during construction and remain throughout the operations and maintenance phase. The potential impact of long term habitat loss persisting after the decommissioning phase has also been considered as the MDS assumes that scour and cable protection will be left *in situ* following decommissioning.

2.9.5.2 The relevant MarESA pressures and their benchmarks which have used to inform this impact assessment are described here:

- 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.

2.9.5.3 These pressures are relevant to the installation of wind turbine and OSP foundations, the associated scour protection and the cable protection which will replace the sedimentary seabed with hard structures for the duration of the operations and maintenance phase (35 year operational lifetime).

2.9.5.4 The subtidal IEFs that have the potential to be affected by long term habitat loss/habitat alteration across all phases of the Morgan Generation Assets are those present within the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF (see Table 2.18)).

Construction and operations and maintenance phases

Magnitude of impact

Subtidal habitat IEFs

2.9.5.5 The presence of the Morgan Generation Assets infrastructure within the Morgan benthic subtidal ecology study area will result in long term habitat loss/habitat alteration. The MDS is for up to 1,309,252 m^2 of long term habitat loss due to the installation of suction bucket jacket foundations and associated scour protection and cable protection associated with wind turbines and all types of cable (Table 2.16). This represents 0.14% of the Morgan benthic subtidal ecology study area.

2.9.5.6 Foundations and associated scour protection may account for up to 760,452 m^2 of the total long term habitat loss/habitat alteration in the Morgan Array Area. Cable protection may account for up to 510,000 m^2 of long term habitat loss/habitat alteration. The MDS accounts for 10% of the inter-array cables and 20% of the interconnector cables having cable protection with a width of 10 m. Additionally cable crossing protection may result in 38,800 m^2 of long term habitat loss/habitat alteration. Cable protection may be required for 10 crossings for the inter-array cable and 10 crossings for the interconnector cable.

2.9.5.7 Long term subtidal habitat loss/habitat alteration potential impacts will commence during the construction phase and will continue through the 35-year operational lifetime.

2.9.5.8 The impact on the subtidal habitat IEFs in the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) 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**.

Sensitivity of receptor

Subtidal habitat IEFs

2.9.5.9 Subtidal habitat IEFs which are expected to be affected by long term habitat loss/alteration are listed in paragraph 2.9.5.4 and Table 2.18. The sensitivity of the subtidal IEFs to long term habitat loss/alteration is presented in Table 2.21. These sensitivities are based on assessments made by the MarESA.

2.9.5.10 All subtidal IEFs have high sensitivity to long term habitat loss/habitat alteration where a change in seabed type would cause a fundamental change in habitat type (Table 2.21). As outlined previously, this habitat alteration represents a small proportion of the Morgan benthic subtidal ecology study area.

2.9.5.11 All of the subtidal IEFs are characterised by their sedimentary composition. To change the seabed to rock or artificial substratum would lead to a loss of the abiotic and biotic features of the biotopes in these IEFs and would result in a reclassification (De-Bastos and Watson, 2023; Tillin and Watson, 2023; Hill *et al*, 2023; Tillin and Watson, 2024a). 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 (further detail on the colonisation of hard structures is presented in section 2.9.5.18).

2.9.5.12 The subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF are deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore considered to be **high**.

Table 2.21: Sensitivity of the benthic IEFs to long term subtidal habitat loss/habitat alteration.

IEF	Representative biotope	Sensitivity to defined MarESA Physical change (to another seabed type)	Overall sensitivity (based on Table 2.14)
Subtidal biotopes			
Subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes	SS.SMu.CSaMu.LkorPpel	High	High
Subtidal coarse and mixed sediments with diverse benthic communities	SS.SCS.CCS	High	High
	SS.SMx.OMx SS.SMx.OMx.PoVen	High	
Seapens and burrowing megafauna communities	SS.SMu.CFiMu.SpnMeg	High	High

Significance of effect

Subtidal habitat IEFs

2.9.5.13 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the long term subtidal habitat loss/habitat alteration impact during the construction and operations and maintenance phases is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. The long term habitat loss/habitat alteration will only affect a small proportion of the total area of these IEFs in the Morgan benthic subtidal ecology study area 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.

Decommissioning phase

Magnitude of impact

2.9.5.14 The presence of any Morgan Generation Assets infrastructure within which is left *in situ* post-decommissioning will result in permanent habitat loss/habitat alteration. The MDS is for up to 1,252,116 m^2 of permanent habitat loss/habitat alteration due to scour protection and cable protection associated with cables and cable crossings being left *in situ* after decommissioning. (i.e. only the foundations being removed). This equates to a very small proportion (0.13%) of the Morgan benthic subtidal ecology study area. In areas of previously soft sediments where the cables and scour protection are left *in situ* on the seabed, the substrate will not return to soft sediments and therefore there is no potential for recovery of sedimentary communities. Throughout the operations and maintenance phase however it is likely that the foundations and cable/scour protection will be colonised by hard structure adapted communities similar to those which occur on the natural hard substrates. The potential impact associated with the colonisation of artificial structures is presented separately in section 2.9.5.18. As a result of this it may be more accurate to refer to the permanent presence of Morgan Generation Assets infrastructure as permanent habitat alteration rather than permanent habitat loss, as used for the other phases, as these artificial structures will provide a basis for benthic communities although they are likely to be different from those originally found at these sites.

2.9.5.15 The impact on the subtidal habitat IEFs in the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) is predicted to be of local spatial extent, long term duration, continuous and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Sensitivity of receptor

Subtidal habitat IEFs

2.9.5.16 The sensitivity of the relevant subtidal habitat IEFs (i.e. subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes

IEF and seapens and burrowing megafauna communities IEF) is as described previously for the construction and operations and maintenance phase assessment in paragraph 2.9.5.9 to 2.9.5.12 and above in Table 2.21.

2.9.5.17 The subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF are deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore considered to be **high**.

Significance of effect

Subtidal habitat IEFs

2.9.5.18 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the permanent subtidal habitat loss/habitat alteration potential impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. The permanent habitat loss/habitat alteration will only affect a small proportion of the total area of these IEFs in the Morgan benthic subtidal ecology study area 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.

2.9.6 Introduction of artificial structures

2.9.6.1 The introduction of artificial structures within the Morgan Generation Assets may result in the colonisation of foundations, scour protection and cable protection by new communities. As outlined in Table 2.16, the MDS also includes for the removal of marine growth from foundations and the potential impacts associated with the deposition of this material on the seabed. This potential impact considers the effects of these new communities on the existing IEFs as well as the physical environment such as the sediment composition of the Morgan benthic subtidal ecology study area.

2.9.6.2 The environmental pressures associated with this potential impact are the same as those associated with long term subtidal habitat loss/habitat alteration 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 wind turbine foundations and cable protection. The pressure is described for the MarESA in paragraph 2.9.5.2.

2.9.6.3 The subtidal IEFs that have the potential to be affected by introduction of artificial structures across all phases of the Morgan Generation Assets are those present within the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF (see Table 2.18)).

Construction and operations and maintenance phases

Magnitude of impact

Subtidal habitat IEF

2.9.6.4 The MDS is for up to 1,791,198 m^2 of area associated with the introduction of artificial structures due to the installation of suction bucket jacket foundations, associated scour protection and cable protection associated with inter-array cables and interconnector cables as well as their associated crossings (Table 2.16). This equates to 0.19% of the Morgan benthic subtidal ecology study area. This value however is likely an over estimation of the area of the artificial structures introduced as it has been calculated assuming the foundations were a solid structure. In reality the suction caisson jacket foundations will have a lattice design rather than a solid surface, which would result in a smaller surface area than has been assumed for the MDS. It is expected that the foundations and scour and cable protection will be colonised by epifaunal species already occurring in the Morgan benthic subtidal ecology study area (e.g. tunicates, bryozoans, mussels and barnacles which are typical of temperate seas).

2.9.6.5 The introduction of artificial structures 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. The introduction of artificial structures may produce some potentially beneficial effects, for example the likely increase in biodiversity and individual abundance of reef species and total number of species over time, as 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 to 500 m from the foundations).

2.9.6.6 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 can also be applied to 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), study of gravity-based foundations in the Belgian part of the North Sea 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.

2.9.6.7 The MDS includes for the removal of marine growth from foundations and access ladders (Table 2.16). As this material may become deposited on the seabed, the reef effect may be enhanced, potentially extending out from the foundation itself. An investigation conducted at the research platform Forschungsplattformen in Nord- und Ostsee 1 FINO 1 in the southwest German Bight in the North Sea reported that yearly, 878,000 single shell halves from *Mytilus edulis* sink onto the seabed from the FINO 1 platform, thereby greatly extending the reef effects created by the construction of the offshore platform structure (Krone *et al*., 2013). Removal of marine growth from the wind turbine foundations may also cause debris to fall within the vicinity of the wind turbine foundation. It is likely that seaweed/algal material would disperse into the water column, with heavier material (e.g. mussels) being deposited within 10 m to 15 m of the foundation. This material has the potential to change the prevailing sediment type in the immediate vicinity of the wind turbines, and therefore extending the reef effect. The impact associated with the potential for the removal of marine growth to release invasive species is assessed in section 2.9.7.

2.9.6.8 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*. (2020) found that, eight to nine years after the installation of C-power and Belwind offshore wind farms (offshore Belgium), the soft sediment epibenthos experienced no significant 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 phase (assuming 25-year operation) on benthic communities inhabiting the baseline sandy environment within many offshore wind farms.

2.9.6.9 The increased biodiversity, species richness and species abundance which has been noted as a result of colonisation of artificial structures such as the jacket foundations of wind turbines, will also provide greater foraging opportunities for some fish species (this has been assessed in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement). This is supported by monitoring from Beatrice offshore wind farm (APEM, 2021) which noted fish and shellfish at the base of foundations although no biological material was recorded on the seabed. Any additionally effects up the food chain are considered in relation to marine mammals (Volume 2, Chapter 4: Marine mammals of the Environmental Statement) and ornithology (Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement) in their individual chapters.

2.9.6.10 A review by Degraer *et al* (2020) explained the process by which wind turbine foundations are colonised and the vertical zonation of species that can occur. In general biofouling communities on offshore installations are dominated by mussels, macroalgae, and barnacles near the water surface, essentially creating a new intertidal zone; filter feeding arthropods at intermediate depths; and anemones in deeper locations (De Mesel *et al*., 2015). Colonisation by these species will likely represent an increase in biodiversity and a change compared to the situation if no hard substrates were present (Lindeboom *et al*., 2011).

2.9.6.11 The impact on the subtidal habitat IEFs in the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) is predicted to be of local spatial extent, long term duration, continuous and irreversible during the lifetime of the Morgan Generation Assets. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Sensitivity of receptor

Subtidal habitat IEFs

2.9.6.12 Subtidal habitat IEFs which are expected to be affected by introduction of artificial structures are listed in paragraph 2.9.6.3 and Table 2.18. The sensitivity of the subtidal IEFs to introduction of artificial structures is presented below. These sensitivities are based on assessments made by the MarESA.

2.9.6.13 The sensitivity of the IEFs to physical change (to another substratum) is as described previously for the long term subtidal habitat loss/alteration assessment and above in 2.9.5.11. The sensitivity for all IEFs to introduction of artificial structures is high.

2.9.6.14 Within the Morgan benthic subtidal ecology study area sediments are dominated by gravelly sand and gravelly muddy sand. As such, the introduction of artificial structures due to installation of foundation structures, associated scour protection, and any cable protection, will represent a shift in community type and will have a direct effect on subtidal habitat IEFs through the colonisation of these hard substrates.

2.9.6.15 Colonisation of the foundations, associated scour protection and cable protection may have indirect adverse effects on the baseline 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 and aggregation of species close to the foundations rather than broad scale studies.

2.9.6.16 Placing the hard structures on the seabed not only creates new habitat but also modifies or removes existing habitat. Often it replaces an essentially two-dimensional sedimentary seabed, such as subtidal sandbanks, with a complex 3-D structure, thereby increasing surface area, surface complexity and number of niches (e.g. 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 but also in the right location and distances from source populations (Marine Pollution Bulletin, 2022). The surface may only be suitable for colonisation after being suitably weathered, through the loss of any surface contaminants, the production of biofilms and the sequence of development of the community after settlement (Marine Pollution Bulletin, 2022).

2.9.6.17 Some studies have also shown that the installation and operation of offshore wind farms have no significant impact on the soft sediment environments. De Backer *et al*. (2020) found that eight to nine years after the installation of C-power and Belwind offshore wind farms (offshore Belgium) the soft sediment epibenthos underwent no drastic changes; and the species originally inhabiting the sandy bottom were still present and remained dominant in both wind farms. Additionally, a review of monitoring from Block Island wind farm in the United States showed no strong gradients of change in sediment grain size, enrichment, or benthic macrofauna within 30 m to 90 m distance bands of the wind turbines (Hutchison *et al*., 2020).

2.9.6.18 The deployment of scour and cable protection may facilitate the colonisation of rock protection by epifaunal species typical of coarse sediment which are found within the Morgan Array Area. Previous studies have shown that for artificial hard substrate to be colonised by a benthic community similar to that of the baseline, its structure should resemble that of the baseline habitat as far as possible (Coolen, 2017). The addition of smaller grained material to scour/cable protection may therefore be of some benefit to the native epifaunal communities (Van Duren *et al*., 2017; Lengkeek *et al*., 2017).

2.9.6.19 The most recent monitoring data at the time of writing this chapter to come from an operational wind farm has come from Beatrice Offshore Wind Farm Post-Construction Monitoring (APEM, 2021). This monitoring was undertaken in October 2020 and used DDV, remotely operated vehicles and grab samples to gather qualitative data on the biofouling community composition on wind turbines (four wind turbines with jacketed foundations in four different locations within the wind farm, assessed to a depth of 45 m) and the surrounding seabed. The results found extensive biofouling on all the wind turbines with signs of zonation and successional development. The zonation was dependent on depth and the dominance of a few key species. Across all wind turbines

Metridium senile plumose anemones and *Spirobranchus triqueter* keel worms were the most abundant species, with the highest biomass found at mid depths of 40 m with lower biomass above and below. The splash zone and top 5 m of the foundations was dominated by algal turf and kelp, this gave way to cnidarian dominated community at around 5 m to 10 m and this transitioned to a keel worm dominated zone between 25 m and 40 m depth. At the base in the immediate vicinity of the wind turbines the *Pagurus bernhardus* hermit crabs, flatfish and *Echinus esculentus* common sea urchin were found with decreasing abundance further from the foundation indicating a source of food although no biological matter could be seen. Gadoid fish could also be seen but not identified to species level. The zonation pattern is likely to remain constant except for small scale changes. The zonation pattern may change if the communities are disturbed by the introduction of a new species such as the *M. edulis* which is notably absent as it commonly found in other wind farms.

2.9.6.20 The introduction of this hard substrate may also have potential impacts on the distribution of species as this kind of artificial infrastructure can influence larval dispersion. Research in this area comes from the oil and gas sector which examines the potential impact of infrastructure regarding the interception and production of larvae (McLean *et al*., 2022). The larvae can be triggered to settle on infrastructure by sound, chemical cues, light and vibrations. Where platforms exist in offshore waters far from natural reef features, their influence on larval dispersal and settlement may be comparatively high, relative to platforms in more naturally connected environments, therefore influencing geographic and population connectivity (McLean *et al*., 2022). As species become established on oil and gas structures, they can start producing larvae (e.g. Henry *et al*., 2018). One such example of this in the North Sea found interannual variability in the North Atlantic Oscillation results in larvae of the protected cold-water coral species, *Lophelia pertusa* being dispersed from oil and gas structures across distances of ~300 km (Fox *et al*., 2016) and into marine protected areas (Henry *et al*., 2018). The influence of oceanographic features in species dispersal and distribution however emphasizes the importance in characterising the hydrodynamics underpinning potential connectivity (Boschetti *et al*., 2020). Potential barriers to settlement, growth, reproduction and survival of larvae on offshore energy infrastructure also exist, including cleaning regimes, surface coatings (e.g. antifoulant) and operational discharges.

2.9.6.21 All of the subtidal IEFs (the subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF) are deemed to be of high vulnerability, low recoverability, and national value. The sensitivity of the IEFs is therefore, considered to be **high**.

Significance of effect

Subtidal habitat IEFs

2.9.6.22 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the colonisation of hard structures impact in the construction and operations and maintenance phases is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion has been reached based on the localised nature of this potential impact which will be largely restricted to the wind turbine and OSP foundations, and the immediate surrounding area, as well as cable and scour protection.

Decommissioning phase

Magnitude of impact

Subtidal habitat IEF

2.9.6.23 The presence of any Morgan Generation Assets infrastructure within the Morgan benthic subtidal ecology study area which is left *in situ* post-decommissioning will result in permanent presence of artificial structures. The MDS is for up to 1,252,116 m^2 of permanent artificial structures due to scour protection and cable protection associated with cables and cable crossings potentially being left *in situ* after decommissioning (i.e. with only the wind turbine and OSP foundations being removed). This equates to a very small proportion (0.13%) of the Morgan benthic subtidal ecology study area. In areas of previously soft sediments where the cables and scour protection are left *in situ* on the seabed, the substrate will not return to soft sediments and will be permanently altered by the presence of cable and scour 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.

2.9.6.24 The impact on the subtidal habitat IEFs in the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) is predicted to be of local spatial extent, long term duration, continuous and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Sensitivity of receptor

Subtidal habitat IEFs

2.9.6.25 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF are as described previously for the construction phase assessment in paragraph 2.9.6.12 to 2.9.6.20.

2.9.6.26 All of the subtidal IEFs (the subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF) are deemed to be of high vulnerability, low recoverability, and national value. The sensitivity of the IEFs is therefore, considered to be **high**.

Significance of effect

Subtidal habitat IEFs

2.9.6.27 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the colonisation of hard structures impact in the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion has been reached based on the localised nature of this potential impact which will be restricted to cable and scour protection.

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

2.9.7.1 The installation/presence of artificial structures and the movements of construction vessels may lead to an increased risk of introduction and spread of INNS across all phases of the Morgan Generation Assets.

2.9.7.2 The benchmark for the relevant MarESA pressure which has been used to inform this impact assessment is described here.

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

2.9.7.3 This pressure is relevant to the introduction of new substrates into an established community.

2.9.7.4 The subtidal IEFs that have the potential to be affected by increased risk of introduction and spread of INNS across all phases of the Morgan Generation Assets are those present within the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF (see Table 2.18)).

Construction phase

Magnitude of impact

Subtidal habitat IEFs

2.9.7.5 The MDS during the construction phase is for the gradual introduction of up to 1,791,198 m^2 of artificial structures and for up to 1,929 vessel round trips during the construction phase, which will occur over a maximum duration of up to four years (Table 2.16).

2.9.7.6 There are however a number of existing vessel movements occurring within the Morgan benthic subtidal ecology study area. Ferries represent a large proportion of the vessel traffic in this region. These ferries primarily move between the mainland UK and Ireland or Northern Ireland. One of the busiest crossings from Heysham to Douglas on the Isle of Man resulted in approximately 1,300 crossings per year (Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement). 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, Holyhead and Fleetwood being the most active. During the offshore geophysical, environmental and geotechnical surveys in 2021 and 2022, 43 to 220 fishing vessels were identified in the Morgan Array Area or in the vicinity (within 10 nm). Approximately 426 to 649 vessels in total pass through the Morgan Array Area per year, a rate of 30 to 46 per day (Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement). The addition of Morgan Generation Assets construction traffic to this region, over a short period (i.e. up to four years), 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.

2.9.7.7 Several INNS have been recorded along the English coast to the east of the Morgan Generation Assets including species such as Wakame *Undaria pinnatifida*, carpet sea squirt *Didemnum vexillum*, Darwin's barnacle *Austrominius modestus*, orange cloak sea squirt *Botrylloides violaceus*, trumpet tubeworm *Ficopotamus enigmaticus* and leathery sea squirt *Styela clava* (North West Wildlife Trust, 2016). The species *F. enigmaticus* is a particular concern as they can become super abundant resulting in a significant biofouling hazard (North West Wildlife Trust, 2022). The government of the Isle of Man have identified that the killer shrimp (*Dikerogammarus villosus*) as well as the carpet sea squirt (*D. vexillum*) are of particular concern (gov.im, 2018).

2.9.7.8 Many of the vessels used during the construction phase of the Morgan Generation Assets 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 Morgan Array Area. Some species however do not require vessel movement to spread, Álvarez-Noriega *et al.* (2020) identified that at high latitudes larvae have greater dispersal distances driven by moderate current speed and longer planktonic durations, enabling the spread of INNS.

2.9.7.9 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 Morgan Generation Assets. There are multiple marine INNS that are now widespread and well established in north Wales. 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 *A. 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 (*Antithamnionella spirographidis, Asterocarpa humilis* 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 Morgan Generation Assets.

2.9.7.10 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). In 2009 an experimental attempt to remove the *D. vexillum* from Holyhead harbour by isolating, smothering and killing the sea squirt using physical (plastic wrapping) and chemical (calcium hypochlorite) methods was documented by Holt and Cordingley (2011). These methods were largely successful following an eight-month treatment period however five months following cessation of removal activities survey work revealed large numbers of very small colonies of *D. vexillum* and rapidly growing larger colonies over a much larger proportion of the marina (Holt and Cordingley, 2011). Further efforts to remove the *D. vexillum* were not pursued. This study highlights the pervasive nature of this species once it is introduced. The slipper limpet *Crepidula fornicata* has also been identified in the north of Cardigan Bay, in the Menai Strait and off the north and west coast of Anglesey. They are typically found attached to shells and stones on sedimentary substrata around the low water mark and the shallow sublittoral (Rayment, 2008). The American piddock *Petricolaria pholadiformis* has also been identified along the north

Wales coast. This species is a mechanical borer into hard clay, chalk, solid mud, peat-moss and limestone from the mid-tide level to low water (Budd, 2005).

2.9.7.11 As set out in Table 2.17, an Offshore EMP will be implemented for the Morgan Generation Assets, which will aim to manage and reduce the risk of potential introduction and spread of INNS so far as reasonably practicable. The Offshore EMP will include a Biosecurity Risk Assessment as well as an INNS Management Plan which will detail the measures to ensure vessels comply with the 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. This will ensure that the risk of potential introduction and spread of INNS will be minimised.

2.9.7.12 The impact on the subtidal habitat IEFs in the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) is predicted to be of local spatial extent, long term duration, intermittent 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

Subtidal habitat IEFs

2.9.7.13 Subtidal habitat IEFs which are expected to be affected by the increased risk of introduction and spread of INNS are listed in paragraph 2.9.7.4 and Table 2.18. The sensitivity of the subtidal IEFs to increased risk of introduction and spread of INNS is presented in Table 2.22. These sensitivities are based on assessments made by the MarESA.

2.9.7.14 The subtidal coarse and mixed sediments with diverse benthic communities IEF has been assessed by the MarESA as having a high sensitivity to the increased risk of introduction and spread of INNS. Few non-indigenous species are able to colonise mobile sands due to the high level of disturbance (Tillin and Watson, 2023; Tillin and Watson, 2024a). The assessment however highlights two specific species of concern, the slipper limpet *C. Fornicata* which can settle on stones and other hard substrate such as bivalve shells to form dense carpets which smother the underlying bivalves (Tillin and Watson, 2023; Tillin and Watson, 2024a). Ultimately this may result in a change to the overall substrate type which may make it unsuitable for the settlement of native larvae. The colonial ascidian *D. vexillum* is present in the UK but appears to be restricted to artificial surfaces, this species may, however, have the potential to colonise and smother offshore gravel habitats (Tillin and Watson, 2023; Tillin and Watson, 2024a). Additionally, although not currently established in UK waters, the whelk *Rapana venosa* may spread to UK habitats from Europe (Tillin and Watson, 2023; Tillin and Watson, 2024a). Both *C. fornicata* and *D. vexillum* have been identified on the north Wales coast and *C. fornicata* has also been identified on the northwest English coast (only one confirmed sighting near Crosby according to the NBN Atlas), therefore have the potential to extend into this biotope. For the majority of the subtidal biotopes the sediments characterising these IEFs are likely to be too mobile or otherwise unsuitable for most of the recorded INNS currently recorded in the UK (Tillin and Watson, 2023; Tillin and Watson, 2024a) however the greatest risk is associated with *C. fornicata*. *C. fornicata* was not recorded in any of the site-specific surveys for the Morgan benthic subtidal ecology study area.

2.9.7.15 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF has been assessed as having a high sensitivity to the increased risk of introduction and spread of INNS. Tillin and Watson (2024b) highlights that few INNS may be able to colonise mobile sands, due to the high levels of sediment disturbance however slipper limpets and *D. vexillum* may be able colonise any artificial structures which are installed in this IEF although they are most commonly found to colonise gravel based sediments.

2.9.7.16 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 2.22). 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 southwest 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). Additionally as noted in paragraphs 2.9.7.9 and 2.9.7.10, 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.

2.9.7.17 The subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF are deemed to be of high vulnerability, low recoverability, and national value. The sensitivity of the IEFs is therefore considered to be **high**.

Table 2.22: Sensitivity of the relevant benthic IEFs to introduction or spread of INNS.

IEF	Representative biotopes	Sensitivity to defined MarESA pressure	Overall sensitivity (based on Table 2.14)
		Introduction or spread of INNS	
Subtidal biotopes			
Subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	High
	SS.SMu.CSaMu.LkorPpel	No evidence	
	SS.SSa.CMuSa SS.SSa.CFiSa.EpusOborApri	High	
Subtidal coarse and mixed sediments with diverse benthic communities	SS.SCS.CCS	High	High
	SS.SMx.OMx SS.SMx.OMx.PoVen	High	
Seapens and burrowing megafauna communities IEF	SS.SMu.CFiMu.SpnMeg	No evidence	High

Significance of effect

Subtidal habitat IEFs

2.9.7.18 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the seapens and burrowing megafauna communities IEF the magnitude of the increased risk of introduction and spread of INNS impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be high. The 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 Morgan benthic subtidal ecology study area 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 Morgan Generation Assets to minimise the effects from introduction or spread of INNS.

Operations and maintenance phase

Magnitude of impact

Subtidal habitat IEFs

2.9.7.19 The installation of artificial structures and the presence of operations and maintenance vessels may lead to an increased risk of introduction and spread of INNS. The MDS is represented by up to 25,165 vessels return trips during the 35-year operations and maintenance phase (or 719 vessel return trips per year) (Table 2.16). Furthermore, the introduction of 1,791,198 m^2 artificial structures, in the form of suction bucket jacket foundations, associated scour protection and cable protection/crossings, has the potential to contribute to the introduction and spread of INNS. As outlined in paragraph 2.9.6.4 the estimate for the surface area of artificial structures introduced is considered to be conservative as the lattice nature of jacket foundations will result in a smaller area of habitat created than has been assumed for a foundation with solid sides in the MDS.

2.9.7.20 Details of INNS of concern in this region are as outlined previously in paragraphs 2.9.7.7 to 2.9.7.10.

2.9.7.21 The removal of encrusted growth may also occur during the operations 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 will be implemented to reduce the transmission of species through actions involved in the various phases of the Morgan Generation Assets (Table 2.17). The Offshore EMP will include a Biosecurity Risk Assessment as well as an INNS Management Plan which will detail the measures to ensure vessels comply with the 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. This will ensure that the risk of potential introduction and spread of INNS will be minimised.

2.9.7.22 The impact on the subtidal habitat IEFs in the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) is predicted to be of local spatial extent, long term duration, intermittent 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

Subtidal habitat IEFs

2.9.7.23 The sensitivity of the IEFs is as described previously for the construction phase assessment in paragraph 2.9.7.13 to 2.9.7.17 and above in Table 2.22.

2.9.7.24 The subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities are deemed to be of high vulnerability, low recoverability, and national value. The sensitivity of the IEFs is therefore considered to be **high**.

Significance of effect

Subtidal habitat IEFs

2.9.7.25 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the increased risk of introduction and spread of INNS impact during the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be high. The 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 Morgan benthic subtidal ecology study area during the operations and maintenance phase, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore measures have been adopted as part of the Morgan Generation Assets to minimise the effects from introduction or spread of INNS.

Decommissioning phase

Magnitude of impact

2.9.7.26 The MDS for the decommissioning phase is for the same number of vessel return trips per year as the construction phase (i.e. 1,929) for four years (see Table 2.22). The MDS for artificial structures in this potential impact is for all infrastructure to remain *in situ*, resulting in the permanent presence of up to 1,252,116 m^2 of artificial structures due to the presence of scour and cable protection, including cable protection for cable crossings, being potentially left *in situ* (0.13% of the Morgan benthic subtidal ecology study area). This could continue to increase the risk of introduction and spread INNS which have developed on these structures on to natural habitats.

2.9.7.27 As set out in Table 2.22, an Offshore EMP will be implemented as part of the Morgan Generation Assets, which will aim to manage and reduce the risk of potential introduction and spread of INNS so far as reasonably practicable. Included in the Offshore EMP will be a Biosecurity Risk Assessment as well as an INNS Management Plan which will detail the measures to ensure vessels comply with the 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. This will ensure that the risk of potential introduction and spread of INNS will be minimised.

2.9.7.28 The impact on the subtidal habitat IEFs in the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) is predicted to be of local spatial extent, long term duration, intermittent 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

Subtidal habitat IEFs

2.9.7.29 The sensitivity of the IEFs is as described previously for the construction phase assessment in paragraph 2.9.7.13 to 2.9.7.17 and above in Table 2.22.

2.9.7.30 The subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF are deemed to be of high vulnerability, low recoverability, and national value. The sensitivity of the IEFs is therefore considered to be **high**.

Significance of effect

Subtidal habitat IEFs

2.9.7.31 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the seapens and burrowing megafauna communities IEF the magnitude of the increased risk of introduction and spread of INNS impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This is due to the very small proportion of hard substrate which could persist post-decommissioning in the Morgan benthic subtidal ecology study area, and the small uplift in vessel traffic which could facilitate the introduction of INNS. Furthermore, measures have been adopted as part of the Morgan Generation Assets to minimise the effects from introduction or spread of INNS.

2.9.8 Removal of hard substrates

2.9.8.1 The removal of hard substrates associated with the decommissioning of foundations during the decommissioning phase will have a direct effect on benthic subtidal IEFs, with the seabed returning to the predominantly coarse and mixed sediments following removal of structures.

2.9.8.2 The relevant MarESA pressure and benchmark which has used to inform this impact assessment is described here.

- 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.

2.9.8.3 This pressure relates to the removal of wind turbine and OSP foundations during the decommissioning phase.

2.9.8.4 The subtidal IEFs that have the potential to be affected by the removal of hard substrate in the decommissioning phase of the Morgan Generation Assets are those present within the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF (see Table 2.18)).

Decommissioning phase

Magnitude of impact

Subtidal habitat IEFs

2.9.8.5 The decommissioning of the Morgan Generation Assets may result in the removal of up to 1,791,198 m^2 of hard substrate associated with the wind turbine and OSP foundations and associated scour protection as well as cable protection/protection for cable crossings (see Table 2.16), resulting in the loss of the associated colonising communities. This equates to 0.19% of the Morgan benthic subtidal ecology study area.

2.9.8.6 The impact on the subtidal habitat IEFs in the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) is predicted to be of local spatial extent, long term duration, continuous and irreversible. It is predicted that the impact will affect the receptors directly. The magnitude is therefore considered to be **low**.

Sensitivity of receptor

Subtidal habitat IEFs

2.9.8.7 Subtidal habitat IEFs which are expected to be affected by the removal of hard substrate are listed in paragraph 2.9.8.4 and Table 2.18. These sensitivities are based on assessments made by the MarESA.

2.9.8.8 The removal of wind turbine and OSP foundations, cable protection, scour protection and cable crossings during decommissioning 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 Morgan Generation Assets infrastructure was present prior to decommissioning would be expected to recover, with benthic communities in these areas recolonising habitats previously lost beneath the foundations. In time, these communities are predicted to revert to their pre-construction state. Recovery of the IEFs affected is likely to be high as a result of the recovery of their natural habitat (recovery will be similar to the temporary habitat disturbance potential impact which is described in paragraph 2.9.4.7). 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 following cessation of dredging (Foden *et al*., 2009). Sandy sediments also recover quickly following cable installation, with little or no evidence of disturbance in the years following cable installation (RPS, 2019). Sandy sediments are likely to recover from disturbance (e.g. aggregate extraction or dredging) within a shorter time period (e.g. months to one to two years; Newell *et al*., 2004). Deeper holes such as those created by foundations may take longer to infill for example at Westemost Rough Offshore Wind Farm the horizontal directional drilling exit pits which were >2 m deep infilled at a rate of up to 1 m per year (RPS, 2019). The degree to which these pits infill over time and the rate of infilling, is likely to be site specific and dependant on the direction of sediment transport processes in the vicinity of the project and these factors are shown to be variable over a relatively small area (RPS, 2019).

2.9.8.9 The subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, high recoverability, and national value. The sensitivity of the IEFs is therefore considered to be **low**.

Significance of effect

Subtidal habitat IEFs

2.9.8.10 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the removal of hard substrates impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion is based on the ability of these habitats to recover following decommissioning and the small scale of the change in relation to the wider Morgan benthic subtidal ecology study area.

2.9.9 Changes in physical processes

2.9.9.1 Changes in physical processes may arise from the installation of infrastructure into the water column within the Morgan Array Area, including scour effects and changes in the sediment transport and wave regimes resulting in potential effects on benthic receptors. Volume 4, Annex 1.1: Physical processes technical report of the Environmental Statement provides a full description of the modelling used to inform this assessment.

2.9.9.2 The relevant MarESA pressures and benchmarks used to inform this impact assessment are described here:

- 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 wind turbine and OSP foundations, cable protection and secondary scour
- 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 wind turbine and OSP foundations and scour protection.

2.9.9.3 These pressures are relevant to the installation of wind turbine and OSP foundations into the water column potentially changing the predominant wave and tidal regime on a small scale.

2.9.9.4 The subtidal IEFs that have the potential to be affected by changes in physical processes in the operations and maintenance phase and decommissioning phase of the Morgan Generation Assets are those present within the Morgan Array Area and ZoI (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF, seapens and burrowing megafauna communities IEF, brittlestar beds IEF and Annex I low resemblance stony reef (outside an SAC) IEF (see Table 2.18)).

2.9.9.5 The West of Walney MCZ IEFs that have the potential to be affected changes in physical processes in the operations and maintenance phase and decommissioning phase of the Morgan Generation Assets are the subtidal mud IEF, subtidal sand IEF and seapens and burrowing megafauna communities IEF (see Table 2.18).

2.9.9.6 The West of Copeland MCZ IEFs that have the potential to be affected by changes in physical processes in the operations and maintenance phase and decommissioning phase of the Morgan Generation Assets are the subtidal coarse sediment IEF, subtidal mixed sediment IEF and subtidal sand IEF (see Table 2.18).

Operations and maintenance phase

Magnitude of impact

Subtidal habitat IEFs

2.9.9.7 The presence of the Morgan Generation Assets infrastructure may obstruct tidal flow and lead to changes in the wave regime and sediment transport and sediment transport pathways. As outlined in Table 2.16, the MDS in terms of hydrographic impacts is for up to 68 wind turbines with four-legged suction bucket foundations for each jacket leg at 5 m diameter and scour protection covering a total footprint of 10,816 m^2 per wind turbine. Additionally, the MDS includes one OSP, with a rectangular gravity base foundation each with an 80 m by 60 m dimension at the surface and a slab base dimension of 100 m by 80 m. Associated scour protection extends from the slab base by 25 m at a height of 2.6 m giving rise to 19,500 m^2 footprint per unit. The parameters in terms of seabed footprint and water column obstruction are similar between each wind turbine unit, as modelled, and each of the four OSP units. Therefore, it is appropriate to infer the impacts on tidal flows due to each of the OSPs would be of the same extent and order of magnitude as those modelled wind turbine sites and to occur at the OSP locations.

2.9.9.8 The results of the modelling presented in Volume 4, Annex 1.1: Physical processes technical report of the Environmental Statement indicated that peak tidal flows are redirected in the immediate proximity of foundations by a maximum variation of 4 cm/s which constitutes less than 3% of the peak flow and reduces significantly with distance from the structures. These changes are also limited to the immediate Morgan Array Area where they may have a direct impact on the hydrodynamic regime and persist for the entire lifecycle of the Morgan Generation Assets. However, they would be imperceptible from natural variation beyond the immediate vicinity of the Morgan Array Area and would be reversible on decommissioning. The limited nature of these changes would not significantly influence the tidal regime which underpins sediment transport. Cable protection will only be used where sufficient trenching depths cannot be achieved.

2.9.9.9 Examination of a 1 in 1 year storm from the west (of greatest influence of approaching storms) shows the deflection of waves by the structures is predicted to result in a reduction in the lee and increases where the waves are deflected either side of each structure. Changes in the wave height are modelled to be in the order of 3 cm equating to <1% of the baseline significant wave height. For a 1 in 20 year storm event, the pattern is similar however the change in wave height at the foundations is 3.5 cm and due to the larger baseline associated with the return period the overall impact on the wave climate is less obvious.

2.9.9.10 With the introduction of infrastructure during the operations and maintenance phase changes may occur in the sediment transport and sediment transport pathways in the Morgan Generation Assets area. One of the measures to be adopted as part of the project design, detailed in Table 2.17, is the provision of scour protection. An Offshore CMS will be developed which will include a CSIP and details of scour protection management to be used around offshore structures and foundations to reduce scour. The scour protection measures will be subject to engineering design to ensure they minimise as much as practical the occurrence of scour. Therefore any impacts would relate only to residual/secondary scour which would be very localised and of negligible magnitude; typically confined to within a few meters of the direct footprint of that scour protection material.

2.9.9.11 To minimise the potential impact from the cables and removal of cables there is a commitment to bury cables where possible. Where burial cannot be achieved to the required depth cable protection may be required. A Cable Burial Risk Assessment and Burial Assessment Study, which will be included within the CSIP, will establish these parameters. The detail of design and construction will be outlined within the CSIP and would also determine the likely extent of any potential scour and would aim to mitigate this through site specific detailed design of scour protection measures as far as practical. 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 scour protection material. During the operations and maintenance phase of the project routine annual inspections will be made of cable and scour protection in line with the Offshore in-principle monitoring plan (Document Reference J11). If secondary scour is identified remedial works may be undertaken to both mitigate environmental impacts and to provide asset security.

2.9.9.12 The use of a single rectangular gravity base OSP forms a greater obstruction to tidal flow. Currents accelerate at the exposed face of the structure and along the sides, whilst decreasing on the sheltered lee side. The variation is a maximum of circa 20% of the tidal current within 50 m of the structure and decreases rapidly with distance. Variations may extend to the proximity of the smaller wind turbine structures but typically less than 1 cm/s. This is a much larger unit than the previous suction bucket foundation types considered with respect to wind turbine structures, however, it would be implemented as a single OSP structure to serve the entire Morgan Generation Assets, with other adjacent wind turbines comprised of the smaller foundation types.

2.9.9.13 Sediment transport is driven by a combination of tidal currents and wave conditions, the magnitude of these has been individually quantified as described above. For a 1 in 1 year storm from the north, during the flood tide the wave climate is in concert with tidal flow and the resultant littoral current is reduced in magnitude. The presence of the structures is predicted to have a limited influence on the wave climate and the modelling showed little difference between changes in littoral current magnitude and the tidal flows alone due to the installation during the flood tide. The extent of the change is predicted to be larger for the ebb tide condition particularly at the locations where the alignment of the array is in concert with both the tidal flow and wave direction, although it should be noted that these are still <1% of baseline tidal flow. Overall, the magnitude of these changes remains limited to ±6% of the baseline currents at 300 m and reduces significantly with increased distance from each structure.

2.9.9.14 Residual currents are effectively the driver of sediment transport and therefore any changes to residual currents would have a direct impact on sediment transport which would persist for the lifecycle of the Morgan Generation Assets. However, if the presence of the foundation structures does not have a significant influence on either tide or wave conditions, they cannot therefore have a significant effect on the sediment transport regime. For completeness, the residual current and sediment transport was simulated with the foundations in place (Volume 4, Annex 1.1: Physical processes technical report of the Environmental Statement). The maximum change in residual current and sediment transport is circa ±10% which is largely sited within close proximity to the wind turbine foundation structures (i.e. as a result of the scour protection). The modelling demonstrated that the residual currents, and resulting sediment transport pathways, will adjust to accommodate the structures and the transport pathways will not be cut off.

2.9.9.15 The use of a single rectangular gravity base OSP forms a greater obstruction to sediment transport than the suction bucket foundations considered for the wind turbine structures. The footprint of the foundation is 19,500 m^2, therefore, the orientation of the unit and the detail of the scour protection design will determine the impact of sediment transport pathways. The influence of an OSP on wave and tides and therefore the driving force of sediment transport, diminished rapidly from the unit, therefore, the OSP being sited within the Morgan Array Area would not induce changes to sediment transport beyond the immediate vicinity or extent to adjacent shorelines.

2.9.9.16 Sandwave clearance may be required at the site of turbine locations, particularly in the case of gravity base structures to accommodate a slab base. For the largest gravity base foundation proposed, the slab base has a diameter of 43 m with scour protection extending 22 m from the slab base. Dredging and sandwave clearance may be required up to a diameter of 173 m to accommodate seabed profiling; therefore, there may be localised disruption to sandwave features.

2.9.9.17 Within the Morgan Array Area there are areas with sandwave features including megaripples in the east and northeast of the site and corridors of barchan dunes in the central and northern parts of the Morgan Array Area. These sandwaves will be reduced in height in order to allow passage of the burial tool to enable cable burial to a sufficient target depth. Significant reductions in sandwave clearance volumes have been identified, from those identified within the PEIR, by detailed analysis of survey data and refining the clearance parameters. Sandwave features are predominately aligned perpendicular to the net sediment transport which is to the east. These individual features are generally circa 1 to 2 km in length, however some barchan dunes meet to form longer features, (ABPmer, 2023).

2.9.9.18 The material which is cleared from the sandwaves to allow passage of the burial tool will not be removed from the site, it will be relocated in close proximity to the sandwave such that it is readily available for sandwave recharge (see Table 2.17). The magnitude, extent and proposed methodology is therefore unlikely to affect the sandwave system as a whole.

2.9.9.19 The rate of reformation of sandwaves is dependent on a range of factors including the size, location and alignment of any breach with respect to the sediment transport pathways and available recharge material. It has been shown that the region has active sediment transport systems with net sediment transport rates of circa 0.75 m^3/d/m within Morgan Array Area and rates more than double this at sandwave crests. Indeed the use of pre-lay trenches is not recommended due to rapid infilling. Increases in littoral currents during storm events would also significantly increase transport rates. The sandwave features themselves are also mobile, typically moving 1 m in an easterly direction each year (ABPmer, 2023). Therefore, although it is not possible to quantify the reformation rate of sandwave breaches with certainty, given the number of variables and dependencies, in an areas of active sediment transport with rechange material available it is anticipated that in the months following installation infilling would become evident. Post installation surveys that will be undertaken for engineering purposes during the operations and maintenance phase may be utilised to monitor these processes.

2.9.9.20 It is proposed to sequester 7,000 m^3 of the dredged material to provide ballast, however with the majority (92.8%) of the dredged material will be placed in the immediate vicinity of the seabed preparation activities. This material will be available for sediment transport under the revised transport pathways, which are altered by typically 10% in the immediate vicinity of the structures as flow and transport are redirected around the infrastructure. Within the Morgan Array Area the seabed sediment is comprised largely of medium to coarse sand and is therefore suited to provide ballast. This, coupled with the diminutive volume, means the removal of coarser fractions would not alter either the local or regional sediment characteristics.

2.9.9.21 The coarse sand which is proposed for use as ballast in gravity base foundations would be drawn from site preparation at each foundation location. Depending on each location, the area affected may vary given the requirement for sandwave clearance or dredging to prepare for the slab base. Typically the area affected corresponds with dredging an area 120 m by 120 m with the material harvested equivalent to 0.5 m in depth. Each of these discrete 120 m by 120 m areas are located a minimum of 1.4 km from each other and in total typically represent 0.36% of the Morgan Array Area. In terms of sediment budget, 490,000 m^3 of the maximum 6,746,105 m^3 seabed preparation volume (which equates to 7.2%) would be used across the Morgan Array Area during the 12 month installation period. This will also equate to an average sediment ballast requirement of 5,104 m^3 per foundation location when 96 gravity base foundations are considered.

2.9.9.22 Typical net sediment transport, under tides alone, though the Morgan Array Area is circa 15,000 m^3 per day; the harvested material therefore represents a one-off 9% reduction in sediment budget during the construction phase and would therefore not significantly influence sediment transport across the Morgan Array Area. As discussed in section 2.9.3, dredging undertaken at the site of the gravity base foundations will be infilled with gravel, with the sequestered material representing a small proportion of this volume and will not result in a void which could potentially interrupt transport processes by intercepting sediment.

2.9.9.23 The natural hydrodynamic regime is highly variable throughout the tidal cycles due to meteorological conditions, as a result the scale of the predicted impacts is well within the natural variation. The changes to tidal currents, wave climate, littoral currents, and sediment transport are insignificant in terms of the hydrodynamic regime. It is predicted that there will be no impact on coastal environments. Effects on tidal current and wave climate would be reversible on decommissioning (i.e. following removal of the wind turbine structures).

2.9.9.24 The impact on the subtidal habitat IEFs in the Morgan benthic subtidal benthic ecology study area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF, seapens and burrowing megafauna communities IEF, brittlestar beds IEF and Annex I low resemblance stony reef (outside an SAC) IEF) is predicted to be of local spatial extent, long term duration, continuous and irreversible during the lifetime of the project. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

West of Walney MCZ

2.9.9.25 Under certain circumstances, namely at times of peak current speeds during flood tides with storms approaching from the southwest, changes in littoral currents may extend to the west edge of the West of Walney MCZ. However, these values amount to changes of less than ±0.022% of the preconstruction tidal current speed and would be indistinguishable from natural variations and the resulting influence on sediment transport characteristics would be very slight.

2.9.9.26 Under certain circumstances changes in wave climate could potentially extend to the periphery of the West of Walney MCZ. For example, during in 1 in 20 year storm from the south west a significant wave height of 5.5 m may be reduced by 4 mm (0.07%) at the south boundary of the West of Walney MCZ. This represents a reduction of less than 0.1% from the preconstruction wave climate and would be indistinguishable from natural variations and the resulting influence on sediment transport characteristics would be *de minimis*.

2.9.9.27 Under certain circumstances, with more extreme storms approaching from the southwest, changes in residual currents may extend to west edge of the West of Walney MCZ. During a 1 in 20 year storm from 270º these values amount to changes of less than ±1% of the preconstruction value and would be indistinguishable from natural variations and the resulting influence on sediment transport characteristics would be minimal. The effects of changes in physical processes on the West of Walney MCZ is also considered within the Morgan Generation Assets MCZ Screening Assessment.

2.9.9.28 The impact is predicted to be of local spatial extent, long term duration, continuous and irreversible during the lifetime of the project. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

West of Copeland MCZ

2.9.9.29 Under certain circumstances, namely at times of peak current speeds during flood tides with storms approaching from the southwest, changes in littoral currents may extend to west edge of the West of Copeland MCZ. However, these values amount to changes of less than ±0.022% of the preconstruction tidal current speed and would be indistinguishable from natural variations and the resulting influence on sediment transport characteristics would be very slight.

2.9.9.30 Under certain circumstances changes in wave climate could potentially extend to the periphery of the West of Copeland MCZ. For example, for a 1 in 20 year storm from 210º the change in significant wave height at the south end of the West of Copeland MCZ is approximately 5 mm. This represents a reduction of less than 0.1% from the preconstruction wave climate and would be indistinguishable from natural variations and the resulting influence on sediment transport characteristics would be *de minimis*.

2.9.9.31 Under certain circumstances, with more extreme storms approaching from the southwest, changes in residual currents may extend to the south tip of the West of Copeland MCZ. These values amount to changes of less than ±1% of the preconstruction values and would be indistinguishable from natural variations and the resulting influence on sediment transport characteristics would be minimal. The effects of changes in physical processes on the West of Copeland MCZ is also considered within the Morgan Generation Assets MCZ Screening Assessment.

2.9.9.32 The impact is predicted to be of local spatial extent, long term duration, continuous and irreversible during the lifetime of the project. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

Subtidal habitat IEFs

2.9.9.33 Subtidal habitat IEFs which are expected to be affected by the changes in physical processes are listed in paragraph 2.9.9.4 and Table 2.18. The sensitivity of the subtidal IEFs to changes in physical processes are as presented in Table 2.23. These sensitivities are based on assessments made by the MarESA.

2.9.9.34 The representative biotopes of the subtidal coarse and mixed sediments with diverse benthic communities IEF have been identified as having an overall negligible sensitivity to the relevant pressures 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 and Watson, 2023; Tillin and Watson, 2024a) resulting in a spatial and demographic shift (e.g. population loss) which is unlikely to lead to any notable changes in these biotopes as a whole. Regarding changes to wave regimes in the Morgan Array Area this IEF occurs in the subtidal and therefore will not be exposed to any change in wave patterns.

2.9.9.35 The representative biotope for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF has also been assessed by the MarESA as having a negligible sensitivity to the pressures associated with this potential impact (Table 2.23). 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 Morgan Generation 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 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 and Watson, 2023).

2.9.9.36 The seapens and burrowing megafauna communities IEF has an overall negligible sensitivity to changes in physical processes (Table 2.23).The seapens and burrowing megafauna communities IEF has a high sensitivity to changes in tidal currents as a long term increase in flow would result in behavioural changes in seapens which would lead to a loss of population. Hiscock (1983) examined the effects of water flow on *Virgularia mirabilis*, and documented changes in their behaviour which included shifting to face away from high-speed currents and eventually resulted in retreating into their burrows when flow exceeded 0.5 m/s, which is a much higher flow than is predicted to arise as a result of the presence of infrastructure within the Morgan Array Area. 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 Morgan benthic subtidal ecology study area however 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 Morgan benthic subtidal ecology study area), 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).

2.9.9.37 The brittlestar beds IEF has an overall negligible sensitivity to changes in physical processes (Table 2.23). 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).

2.9.9.38 The Annex I low resemblance stony reef (outside an SAC) IEF is assessed as having a negligible sensitivity to the relevant pressures (Table 2.23) 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 potential impact however makes it unlikely conditions detrimental to this biotope will be produced. Additionally in the Morgan Array Area ZoI this IEF occurs in the subtidal and therefore will not be exposed to any change in wave exposure.

2.9.9.39 The subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, brittlestar beds IEF and the Annex I low resemblance stony reef (outside an SAC) IEF are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible**.

2.9.9.40 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).

West of Walney MCZ

2.9.9.41 The subtidal mud IEF and subtidal sand IEF in the West of Walney MCZ are assessed by the MarESA as having a negligible sensitivity to the pressures associated with this potential impact. The sensitivity of these IEFs is likely to be similar to those expected for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF (paragraph 2.9.9.35). Sand and mud particles can be eroded with increased water flow rates or wave exposure however the characteristic species of this biotope, *Amphiura filiformis, Mysella bidentata* and *Thyasira sp.* has been found in a range of tidal flow rates and *A. filiformis* can change from filter to deposit feeding depending on the conditions (Ockelmann and Muus, 1978). Furthermore, as these biotopes occurs 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.

2.9.9.42 The sensitivity of the seapens and burrowing megafauna communities IEF within the West of Walney MCZ is as described for this subtidal habitat IEF in paragraph 2.9.9.36.

2.9.9.43 The subtidal mud IEF and subtidal sand IEF within the West of Walney MCZ are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible**.

2.9.9.44 The seapens and burrowing megafauna communities IEF within the West of Walney MCZ 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).

West of Copeland MCZ

2.9.9.45 The sensitivity of the subtidal coarse sediment IEF and subtidal mixed sediment IEF in the West of Copeland MCZ is as described for the subtidal coarse and mixed sediments with diverse benthic communities IEF in paragraph 2.9.9.34. These IEFs are unlikely to be affected by changes in physical processes as they are found in a variety of conditions and the modelled level of change is very small.

2.9.9.46 The sensitivity of the subtidal sand IEF in the West of Walney MCZ is as described previously for the subtidal sand IEF in the West of Walney MCZ in paragraph 2.9.9.41. 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 Morgan Generation Assets is unlikely to result in any adverse effect.

2.9.9.47 The subtidal coarse sediment IEF, subtidal mixed sediment IEF and subtidal sand IEF within the West of Walney MCZ are deemed to not be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible**.

Table 2.23: Sensitivity of all of the relevant IEFs to changes in physical processes.

IEF	Representative biotope	Sensitivity to defined MarESA pressure		Overall sensitivity (based on Table 2.14)
		Water flow (tidal current) changes (local)	Wave exposure changes (local)	
Subtidal biotopes				
Subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	Not sensitive	Negligible
	SS.SMu.CSaMu.LkorPpel.	Not sensitive	Not sensitive	
	SS.SSa.CMuSa SS.SSa.CFiSa.EpusOborApri	Not sensitive	Not sensitive	
Subtidal coarse and mixed sediments with diverse benthic communities	SS.SCS.CCS	Not sensitive	Not sensitive	Negligible
	SS.SMx.OMx SS.SMx.OMx.PoVen	Not sensitive	Not sensitive	
Brittlestar beds	SS.SMx.CMx.OphMx	Not sensitive	Not sensitive	Negligible
Annex I low resemblance stony reef (outside an SAC)	CR.HCR.XFa.SpNemAdia.	Not sensitive	Not sensitive	Negligible
Seapens and burrowing megafauna communities	SS.SMu.CFiMu.SpnMeg	High	Not sensitive	High (reduced to medium in absence of seapens)
West of Walney MCZ				
Subtidal mud	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	Not sensitive	Negligible
Subtidal sand	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	Not sensitive	Negligible
	SS.SMx.CMx.KurThyMx	Not sensitive	Not sensitive	
Seapens and burrowing megafauna communities	SS.SMu.CFiMu.SpnMeg	High	Not sensitive	High (reduced to medium in absence of seapens)

IEF	Representative biotope	Sensitivity to defined MarESA pressure		Overall sensitivity (based on Table 2.14)
		Water flow (tidal current) changes (local)	Wave exposure changes (local)	
West of Copeland MCZ				
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
Subtidal sand	SS.SMu.CSaMu.AfilKurAnit	Not sensitive	Not sensitive	Negligible

Significance of effect

Subtidal Habitat IEFs

2.9.9.48 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, brittlestar beds IEF and the Annex I low resemblance stony reef (outside an SAC) IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the small magnitude and highly localised changes in physical processes predicted as a result of the Morgan Generation Assets and the high resistance of these IEFs to this potential impact.

2.9.9.49 Overall, for the seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms.

West of Walney MCZ

2.9.9.50 Overall, for the subtidal sand IEF and subtidal mud IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the small magnitude and highly localised changes in physical processes predicted as a result of the Morgan Generation Assets and the high resistance of these IEFs to this potential impact.

2.9.9.51 Overall, for the seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

West of Copeland MCZ

2.9.9.52 Overall, for the subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the small magnitude and highly localised changes in physical processes predicted as a result of the Morgan Generation Assets and the high resistance of these IEFs to this potential impact.

Decommissioning phase

Magnitude of impact

Subtidal habitat IEFs

2.9.9.53 Following decommissioning, changes to tidal and wave regime as well as the sediment transport and sediment pathways would be of lesser magnitude than the operations and maintenance phase as no structures would remain in the water column to influence tidal currents, waves or the littoral currents above bed level, with only the colonised scour and cable protection retained within the context of the MDS.

2.9.9.54 The impact on the subtidal habitat IEFs in the Morgan benthic subtidal benthic ecology study area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF, seapens and burrowing megafauna communities IEF, brittlestar beds IEF and Annex I low resemblance stony reef (outside an SAC) IEF) is predicted to be of local spatial extent, long term duration, continuous and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

West of Walney MCZ

2.9.9.55 As the wind turbine and OSP foundations will be removed in the decommissioning phase the magnitude of change for tidal and wave regime as well as the sediment transport and sediment pathways would be of lesser magnitude than the operations and maintenance phase.

2.9.9.56 The impact is predicted to be of local spatial extent, long term duration, continuous and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

West of Copeland MCZ

2.9.9.57 As the wind turbine and OSP foundations will be removed in the decommissioning phase the magnitude of change for tidal and wave regime as well as the sediment transport and sediment pathways would be of lesser magnitude than the operations and maintenance phase.

2.9.9.58 The impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

Subtidal habitat IEFs

2.9.9.59 The sensitivity of the subtidal habitat IEFs (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF, seapens and burrowing megafauna communities IEF, brittlestar beds IEF and Annex I low resemblance stony reef (outside an SAC) IEF) is as described previously for the construction phase assessment in paragraph 2.9.9.33 to 2.9.9.38 and above in Table 2.23.

2.9.9.60 The subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by

Lagis koreni and other polychaetes IEF, brittlestar beds IEF and the Annex I low resemblance stony reef (outside an SAC) IEF are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible**.

2.9.9.61 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).

West of Walney MCZ

2.9.9.62 The sensitivity of the West of Walney MCZ IEFs (i.e. seapens and burrowing megafauna communities IEF and subtidal mud IEF and subtidal sand IEF) is as described previously for the construction phase assessment in paragraph 2.9.9.41 to 2.9.9.42 and above in Table 2.23.

2.9.9.63 The subtidal mud IEF and subtidal sand IEF within the West of Walney MCZ are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible**.

2.9.9.64 The seapens and burrowing megafauna communities IEF within the West of Walney MCZ 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).

West of Copeland MCZ

2.9.9.65 The sensitivity of the West of Copeland MCZ IEFs (i.e. subtidal coarse sediment IEF, subtidal mixed sediment IEF and subtidal sand IEF) is as described previously for the construction phase assessment in paragraph 2.9.9.45 to 2.9.9.46 and above in Table 2.23.

2.9.9.66 The subtidal coarse sediment IEF, subtidal mixed sediment IEF and subtidal sand IEF within the West of Copeland MCZ are deemed to not be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible**.

Significance of effect

Subtidal habitat IEFs

2.9.9.67 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, brittlestar beds IEF and the Annex I low resemblance stony reef (outside an SAC) IEF the magnitude of the changes in physical processes impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

2.9.9.68 Overall, for the seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the highly localised nature of the impact around the scour and cable protection which may be retained following decommissioning.

West of Walney MCZ

2.9.9.69 Overall, for the subtidal sand IEF and subtidal mud IEF the magnitude of the changes in physical processes impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

2.9.9.70 Overall, for the seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached based on the highly localised nature of the impact around the scour and cable protection which may be retained following decommissioning.

West of Copeland MCZ

2.9.9.71 Overall, for the subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the changes in physical processes impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

2.9.10 Electromagnetic fields (EMFs) from subsea electrical cables

2.9.10.1 The presence and operation of inter-array and interconnector cables within the Morgan Array Area may lead to localised EMFs affecting benthic subtidal receptors.

2.9.10.2 The subtidal IEFs that have the potential to be affected by EMFs from subsea electrical cables in the operations and maintenance phase of the Morgan Generation Assets are those present within the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF (see Table 2.18)).

Operations and maintenance phase

Magnitude of impact

Subtidal habitat IEFs

2.9.10.3 EMF comprise both the electrical fields, measured in volts per metre (V/m), and the magnetic fields, measured in microtesla (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).

2.9.10.4 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 the Proposed Development) changes direction (as per the frequency of the AC transmission) and creates a constantly varying electric field in the surrounding marine environment (Huang, 2005).

2.9.10.5 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 inter-array and export cables buried between 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.

2.9.10.6 CSA (2019) investigated the relationship between voltage, current, and burial depth, the results of which are presented in Table 2.24 which shows the magnetic and induced electric field levels expected directly over the undersea power cables and at distance from the cable for inter-array and export cables. Directly above the cable, EMF levels decrease with increasing distance from the seafloor to 1 m above the cable, while as you move laterally 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 2.24: 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 to 7.5 m laterally away from cable**	
	1 m above seafloor	At seafloor	1 m above seafloor	At seafloor
Inter-array	0.0005 to 0.0015	0.002 to 0.0065	<0.00001 to 0.0007	<0.00001 to 0.0010
Export cable	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 to 7.5 m laterally away from cable**	
	1 m above seafloor	At seafloor	1 m above seafloor	At seafloor
Inter-array	0.00001 to 0.00012	0.0001 to 0.00017	0.000001 to 0.00009	0.000001 to 0.00011
Export cable	0.00002 to 0.0002	0.00019 to 0.00037	0.000002 to 1.1	0.000004 to 0.00013

2.9.10.7 During the operations and maintenance phase of the Morgan Generation Assets there will be up to 390 km of 66 kV to 132 kV HVAC inter-array cables and up to 60 km of 275 kV HVAC interconnector cables (Table 2.16). The minimum burial depth for cables will be 0.5 m.

2.9.10.8 The impact on the subtidal habitat IEFs in the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) is predicted to be of local spatial extent, long term duration, continuous and high reversibility (when the cables cease transmitting electricity post- decommissioning). It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **negligible**.

Sensitivity of receptor

Subtidal habitat IEFs

2.9.10.9 Subtidal habitat IEFs which are expected to be affected by the EMF from subsea electrical cables are listed in paragraph 2.9.10.2 and Table 2.18. The sensitivity of the subtidal IEFs to EMF from subsea electrical cables are as presented below. These sensitivities are based on assessments made by the MarESA.

2.9.10.10 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). 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.

2.9.10.11 Experimental evidence has demonstrated that exposure to EMF did not change the distribution of the ragworm *H. diversicolor* (Jakubowska *et al*., 2019). Experimental evidence has 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). 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 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 µT were found to have limited physiological and behavioural impacts, far above levels expected to be generated from cables from the Morgan Generation Assets. Exposure to 500 µT and 1000 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). Further research by Harsanyi et al (2022) examined the effect of EMF on crab (*Cancer pagurus*) and lobster (*Homarus gammarus*) early development. Chronic exposure to 2.8 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 potential impact could occur over. Normandeau (2011) summarised that, despite these sensitivities, no direct evidence of impacts to invertebrates from undersea cable EMFs exists. What is known about invertebrate sensitivities to EMF does provides some guidance for considering likely significant effects. Likely significant effects would depend on the sensory capabilities of a species, the life functions that it's magnetic or electric sensory systems support, and the natural history characteristics of the species. Life functions supported by the electric and magnetic sense indicate that species capable of detecting magnetic fields face likely significant effects different from those that detect electric fields.

2.9.10.12 The conclusion that the potential 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).

2.9.10.13 Shellfish which also inhabit the sea floor, are anticipated to be more sensitive to EMF. Scott *et al*. (2021), investigated the effects of different strength EMF exposure on the commercially important edible crab *Cancer pagurus*. This investigation measured stress related parameters as well as behavioural and response parameters over a 24-hour period. The results of this investigation indicated that exposure to 500 µT and 1,000 µT were found to attract crabs, limiting their time spent roaming as well as disrupt some stress related parameters leading to increased physiological stress when exposed to EMF of 500 µT or above. These results however are not directly applicable to the cables used in the Morgan Generation Assets as the magnetic field levels tested are an order of magnitude higher than what you would expect for a buried cable such as those at the Morgan Generation Assets. Effects of EMF on shellfish receptors are fully considered in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement.

2.9.10.14 Research regarding the potential impact of EMF on invertebrates still has a number of knowledge gaps which hinder the ability to fully understand the effects. Hervé (2021) identifies that establishing the impact on groups such as Molluscs is highly underdeveloped, the impact on species relative to the strength of the EMF as well as the impact of different types of cable are key knowledge gaps.

2.9.10.15 In summary, 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. 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 the conclusion of sensitivity below.

2.9.10.16 EMF may result in very minor loss or detrimental alteration to one or more characteristics, features or elements of the subtidal habitat IEFs.

2.9.10.17 The subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF are deemed to be of low vulnerability (recoverability is not applicable to this potential impact) and national value. The sensitivity of the IEFs is therefore, considered to be **low**.

Significance of effect

Subtidal habitat IEFs

2.9.10.18 Overall, for the subtidal coarse and mixed sediment with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the EMF from subsea cables impact in the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached due to the limited effects associated with EMF which have been described only affecting a small group of organisms as well as the small area over which potentially EMF effects will occur.

2.9.11 Heat from subsea electrical cables

2.9.11.1 The presence and operation of inter-array and interconnector cables within the Morgan Array Area may lead to localised heating of seabed affecting benthic subtidal receptors.

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

- Temperature increase (local): An increase of 5 °C for one month, or 2 °C for one year.

2.9.11.3 The subtidal IEFs that have the potential to be affected by heat from subsea electrical cables in the operations and maintenance phase of the Morgan Generation Assets are those present within the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF (see Table 2.18)).

Operations and maintenance phase

Magnitude of impact

Subtidal habitat IEFs

2.9.11.4 Submarine power cables such as those to be installed for the Morgan Generation 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.

2.9.11.5 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 Windfarm 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).

2.9.11.6 Additionally the potential 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 (HVDC) 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 to 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.

2.9.11.7 A number of environmental factors have been identified which change the way that heat from subsea cables will dissipate. One of them being 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 sands they observed convective heat transfer when the heat sources surface temperature reached over 20^{o}C 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 (>9^{o}C) 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).

2.9.11.8 During the operations and maintenance phase of the Morgan Generation Assets there will be up to 500 km of 66 kV to 132 kV HVAC inter-array cables and up to 60 km of 275 kV HVAC interconnector cables (Table 2.16). The minimum burial depth for cables will be 0.5 m.

2.9.11.9 The impact on the subtidal habitat IEFs in the Morgan Array Area (i.e. subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF) is predicted to be of local spatial extent, long term duration, continuous and high reversibility (when the cables cease transmitting electricity post-decommissioning). It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **negligible**.

Sensitivity of receptor

Subtidal habitat IEFs

2.9.11.10 Subtidal habitat IEFs which are expected to be affected by the heat from subsea electrical cables are listed in paragraph 2.9.11.3 and Table 2.18. The sensitivity of the subtidal IEFs to heat from subsea electrical cables are as presented in Table 2.25. These sensitivities are based on assessments made by the MarESA.

2.9.11.11 The sensitivity of the subtidal coarse and mixed sediments with diverse benthic communities IEF representative biotopes to local temperature increase is assessed as low by the MarESA based on the thermal limits of their characteristic benthic species. For example the characterising bivalve *Timoclea ovata* has a wide distribution from north Norway and Iceland south to west Africa. It is also recorded from the Canary Islands, the Azores and the Mediterranean and Black Sea (Morton, 2009) adapting to the temperature regime at each location as well as local seasonal variations. Temperature cues influence the timing of gametogenesis and spawning in several species present in the biotope. Many polychaete species including *Mediomastus fragilis, Owenia fusiformis* and *Protodorvillea kefersteini* recruit in spring/early summer recruitment (Sardá *et al*., 1999). 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 as a whole.

2.9.11.12 The sensitivity of the representative biotope of the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF to local temperature increase is assessed as low by the MarESA. The characteristic species of this biotope, *Lagis koreni* and *Phaxas pellucidus*, both have a wide distribution and are likely to be found in the north and south of the UK where typical surface water temperatures vary seasonally from 4 to 19°C (Huthnance, 2010). Elevated temperatures may affect growth of some of the characterising species, but no mortality is expected (De-Bastos and Watson, 2023). It is therefore likely that *Lagis koreni* and *Phaxas pellucidus* are able to resist a long-term increase in temperature of 2°C (De-Bastos and Watson, 2023) which is well within the potential temperature rise which may result from offshore subsea cables.

2.9.11.13 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). *Virgularia mirabilis* are recorded across very different environmental conditions, including western 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 Morgan Generation Assets) (Hill *et al*., 2023).

2.9.11.14 The subtidal coarse and mixed sediments with diverse benthic communities IEF and the subtidal sand and muddy sand sediments with benthic communities dominated by

Lagis koreni and other polychaetes IEF are deemed to be of low vulnerability, high recoverability, and national value. The sensitivity of the IEFs is therefore considered to be **low**.

2.9.11.15 The seapens and burrowing megafauna communities IEF are deemed to be of medium vulnerability, medium recoverability, and national value. The sensitivity of the IEFs is therefore considered to be **medium**.

Table 2.25: Sensitivity of the relevant benthic IEFs to heat from cables.

IEF	Representative biotopes	Sensitivity to defined MarESA pressure	Overall sensitivity (based on Table 2.14)
		Temperature increase (local)	
Subtidal biotopes			
Subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes	SS.SMu.CSaMu.LkorPpel	Low	Low
Subtidal coarse and mixed sediments with diverse benthic communities	SS.SCS.CCS	Low	Low
	SS.SMx.OMx SS.SMx.OMx.PoVen	Low	
Seapens and burrowing megafauna communities	SS.SMu.CFiMu.SpnMeg	Medium	Medium

Significance of effect

Subtidal habitat IEFs

2.9.11.16 Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF and the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF the magnitude of the heat from electrical cables impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be low. 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 communities of these IEFs.

2.9.11.17 Overall, for the seapens and burrowing megafauna communities IEF the magnitude of the heat from electrical cables impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be medium. 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 communities of these IEFs.

2.9.12 Future monitoring

2.9.12.1 Overall, no effects which are significant in EIA terms have been identified therefore, in terms of benthic subtidal ecology, no specific monitoring is required.

2.9.12.2 Monitoring related to undertaking maintenance activities is outlined in the project description, Volume 1, Chapter 3: Project description of the Environmental Statement. This includes routine inspections of inter-array and interconnector cables to ensure the cables are buried to an adequate depth and not exposed. It is anticipated that geophysical surveys will be required as a condition of the marine licence.

2.9.12.3 In addition, as outlined in the Offshore in-principle monitoring plan (Document Reference J11), DDV asset integrity surveys of the foundations will likely be undertaken at least every four years during the operations and maintenance phase using a remotely operated vehicle. Any footage available from these surveys will be reviewed by suitably experienced marine ecologists to determine whether the quality would allow for the identification of INNS. If so, the footage would be reviewed by suitably experienced marine ecologists in accordance with the requirements of the INNS Management Plan which will be included in the Offshore EMP (see Table 2.17).

2.10 Cumulative effect assessment methodology

2.10.1 Methodology

2.10.1.1 The CEA takes into account the impacts associated with the Morgan Generation Assets together with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets, the Morecambe Offshore Windfarm: Generation Assets, and 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 3, Annex 5.1: CEA screening matrix of the Environmental Statement). 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.

2.10.1.2 The benthic subtidal ecology CEA methodology has followed the methodology set out in Volume 1, Chapter 5: EIA methodology of the Environmental Statement.

2.10.1.3 The cumulative assessment considers three scenarios:

- Scenario 1: Morgan Generation Assets plus Morgan and Morecambe Offshore Wind Farms: Transmission Assets
- Scenario 2: Morgan Generation Assets plus Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets
- Scenario 3: Morgan Generation Assets plus Morgan and Morecambe Offshore Wind Farms: Transmission Assets alongside all other projects, plans and activities. This assessment has been allocated into 'tiers' reflecting the current stage of the other projects, plans and activities within the planning and development process. This tiered approach is adopted to provide a clear assessment of the Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets alongside other projects, plans and activities:
  - Tier 1: includes projects, plans and activities at the following stages:
    - Under construction
    - Permitted application
    - Submitted application
    - Those currently operational that were not operational when baseline data were collected, and/or those that are operational but have an on-going impact8.
  - Tier 2: includes projects, plans and activities at the following stages:
    - Scoping report has been submitted and is in the public domain.
  - Tier 3 includes projects, plans and activities at the following stages:
    - Scoping report has not been submitted and is not in the public domain
    - Identified in the relevant Development Plan
    - Identified in other plans and programmes.

2.10.1.4 This approach to CEA has been developed to provide an assessment of the Morgan Generation Assets together with the Morgan and Morecambe Offshore Wind Farms:

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[8] On-going impacts can refer to temporary habitat disturbance associated with operational and maintenance activities.

Transmission Assets (Scenario 1) and the Morecambe Offshore Windfarm: Generation Assets (Scenario 2) in order to identify, as far as possible, the combined effects of these three applications separately from the assessment that includes all other projects, plans and activities (Scenario 3).

2.10.1.5 The specific projects, plans and activities scoped into the CEA, are outlined in Table 2.26.

2.10.1.6 A number of the impacts considered for the Morgan Generation Assets alone, as outlined in Table 2.16 and section 2.7.1.2, have not been considered within the CEA due to the localised and temporally restricted nature of these impacts. These impacts include:

- Disturbance/remobilisation of sediment-bound contaminants
- EMF from subsea electrical cabling
- Heat from subsea electrical cables.

Table 2.26: List of other projects, plans and activities considered within the CEA (ordered by distance).

Project/Plan	Status	Distance from the Morgan Generation Assets (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Morgan Generation Assets
Morgan Generation Assets	**-**	**-**	**-**	**Q1 2026 to Q4 2029**	**Q1 2030 to Q4 2065**	**-**
Tier 1						
Offshore renewables projects						
Walney 1 and 2 Offshore Wind Farms Operational Marine Licence - operations and maintenance activities (MLA/2016/00151/3)	Operational	7.5	Covers licensable O&M activities to be carried out as and when required over the lifetime of the wind farms.	n/a	2016 to 2032	The operations and maintenance activities associated with this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Walney (3 and 4) Extension Offshore Wind Farm	Operational (with ongoing activities)	8.10	Up to 87 wind turbines	2014 to 2018	2018 to 3039	The operations and maintenance and decommissioning phases of this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Mona Offshore Wind Project	Pre-application	11.1	Up to 96 wind turbines	2026 to 2029	2030 to 2065	The construction, operations and maintenance and decommissioning phases of this project will overlap with the construction, operations and maintenance and decommissioning phases of the Morgan Generation Assets.

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Project/Plan	Status	Distance from the Morgan Generation Assets (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Morgan Generation Assets
Walney 2 Offshore Wind Farm	Operational (with ongoing activities)	13.3	Up to 51 wind turbines	2007 to 2012	2012 to 2032	The operations and maintenance and decommissioning phases of this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
West of Duddon Sands Offshore Wind Farm	Operational (with ongoing activities)	15.4	Up to 108 wind turbines	2008 to 2014	2014 to 2033	The operations and maintenance and decommissioning phases of this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
West of Duddon Sands Offshore Wind Farm Operational Marine Licence operations and maintenance activities (MLA/2016/00150/3)	Operational	15.4	Covers licensable operations and maintenance activities to be carried out as and when required over the lifetime of the wind farm.	n/a	2016 to 2037	The operations and maintenance activities associated with this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Walney 1 Offshore Wind Farm	Operational (with ongoing activities)	16.3	Up to 51 wind turbines	2007 to 2011	2011 to 2032	The operations and maintenance and decommissioning phases of this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Walney 2 Offshore Wind Farm Operational Marine Licence -	Operational	18.1	Operations and maintenance events including removal of	n/a	2018 to 2038	The operations and maintenance activities

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Project/Plan	Status	Distance from the Morgan Generation Assets (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Morgan Generation Assets
composite operations and maintenance activities (MLA/2017/00429/1)			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 resolve secondary scour issues.			associated with this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Walney Offshore Wind Farm Operational Marine Licence - phase 2 export cable (MLA/2014/00027/7)	Operational	18.1	Emergency export cable repairs over the operational lifetime of the Walney Offshore Wind Farm export cables (2) to ensure adequate contingency plans are in place to react to a major breakage/fault within a reasonable period of time.	n/a	2014 to 2037	Cable repair/remediation activities associated with this project overlaps with the construction and operations and maintenance phases of the Morgan Generation Assets.
Walney Offshore Wind Farm Operational Marine Licence - phase 1 export cable (MLA/2014/00028/5)	Operational	20.3	Emergency export cable repairs over the operational lifetime of the Walney Offshore Wind Farm export cables (2) 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	Cable repair/remediation activities associated with this project overlaps with the construction and operations and maintenance phases of the Morgan Generation Assets.
Walney Offshore Wind Farm Operational Marine Licence -	Operational	20.3	For future cable repair/remediation/protection	n/a	2017 to 2037	The operations and maintenance activities

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Project/Plan	Status	Distance from the Morgan Generation Assets (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Morgan Generation Assets
composite operations and maintenance activities (MLA/2017/00081/2)			works on the Walney 1 export cable and also for potential repair works on the Walney 1 Offshore Substation Platform.			associated with this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Ormonde Offshore Wind Farm	Operational (with ongoing activities)	24.4	Up to 30 wind turbines	2009 to 2010	2011 to 2036	The operations and maintenance and decommissioning phases of this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Ormonde Offshore Wind Farm Operational Marine Licence - operations and maintenance activities (MLA/2016/00224/2)	Operational	24.4	Operations and maintenance activities to be carried out as and when required over the lifetime of the wind farm.	n/a	2017 to 2037	The operations and maintenance activities associated with this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Routine operations and maintenance activities at five OSPs (Barrow, Ormonde, Lincs, Westermost Rough, and Gunfleet Sands) (MLA/2017/00100/1)	Operational	26.2	Repainting of offshore structures, removal of algal growth/bird guano and removal of growth around J Tubes.	n/a	2017 to 2038	The operations and maintenance activities associated with this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Ormonde Offshore Wind Farm Operational Marine Licence - export cable repair and	Operational	27.	Five cable repair events, with associated jacking-up; and 10 cable remediation events (via jetting).	n/a	2015 to 2030	Cable repair/remediation activities associated with this project overlaps with the construction and

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Project/Plan	Status	Distance from the Morgan Generation Assets (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Morgan Generation Assets
remediation (MLA/2015/00086/2)						operations and maintenance phases of the Morgan Generation Assets.
Barrow Offshore Wind Farm	Operational (with ongoing activities)	30.1	Up to 30 wind turbines	2003 to 2006	2006 to 2028	The operations and maintenance and decommissioning phases of this project will overlap with the construction phase of the Morgan Generation Assets.
Barrow Offshore Wind Farm Operational Marine Licence - operations and maintenance (MLA/2016/00149/3)	Operational	107.6	This licence permits a number of operations and maintenance activities including: • Removal of marine growth and/or guano • Replacement of access ladders.	n/a	2016 to 2026	The operations and maintenance activities associated with this project will overlap with the construction phase of the Morgan Generation Assets.
Barrow Offshore Wind Farm Operational Marine Licence - export cable repair and remediation (MLA/2015/00077)[9]	Operational	34.7	Five x cable repair events, with associated jacking-up; and 10 x cable remediation events (via jetting).	n/a	2015 to 2030	Cable repair/remediation activities associated with this project overlaps with the construction and operations and maintenance phases of the Morgan Generation Assets.
Walney Offshore Wind Farm Operational Marine Licence - inter array cable repair (MLA/2013/00426/2)	Operational	37.9	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

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[9] MMO marine licence case reference

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Project/Plan	Status	Distance from the Morgan Generation Assets (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Morgan Generation Assets
						maintenance phases of the Morgan Generation Assets.
Awel y Môr Offshore Wind Farm	Consented	46.8	Up to 48 to 91 wind turbines	2026 - 2030	2030 to 2055	The construction, operations and maintenance and decommissioning phases of this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Oil and Gas						
Millom West Platform	Decommissioning	3.1	Millom west field platform, proposed for decommissioning. Wells will be plugged and cut 3 m below the level of the seabed. Wellheads will be removed and all equipment above the seabed will removed.	n/a	Decommissioning 2024 to 2030	Project decommissioning phase overlaps with the Morgan Generation Assets construction phase and operations and maintenance phase.
Isle of Man Crogga Licence (112/25)	Permitted	9.6	Licence for exploratory geotechnical and geophysical surveys as well as exploratory drilling,	Ending 2025	2026 onwards	Isle of Man Crogga Licence (112/25).
Dredging activities and dredge disposal sites						
Douglas Harbour Dredging	Operational (with ongoing activities)	22.7	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	Dredging and disposal activities associated with this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Project/Plan	Status	Distance from the Morgan Generation Assets (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Morgan Generation Assets
			deposited at a licensed site off Douglas Head.			
Port of Barrow maintenance dredging disposal licence (MLA/2015/00458/1)	Operational (with ongoing activities)	35.9	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.	n/a	2016 to 2026	Dredging and disposal activities associated with this project will overlap with the construction phase of the Morgan Generation Assets.
Walney Extension pontoon/jetty dredging and disposal (DC10142)	Operational	35.7	A Marine Licence is being sought for dredging and associated disposal activities for the Walney Extension Offshore Wind Farm operations and maintenance base at the Port of Barrow.	n/a	2019 to 2029	Walney Extension pontoon/jetty dredging and disposal (DC10142).
West of Duddon Sands Pontoon Dredging Marine Licence	Operational (with ongoing activities)	39.0	Sedimentation can cause the pontoon edge adjacent to the harbour wall to be raised during spring low tides. The scope of the marine licence application covers dredging which will be required annually based on the current observed rates of accumulation.	n/a	2018 to 2028	The operations and maintenance activities associated with this project will overlap with the construction phase of the Morgan Generation Assets.
Maintenance Dredging Peel Harbour Isle of Man	Operational (with ongoing activities)	39.7	Capital harbour dredging, and maintenance dredging. The next extraction is likely to take place in 2026 with an extraction ammount of approximately 23,000 m^3.	n/a	2022 to 2037	The operations and maintenance activities associated with this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.

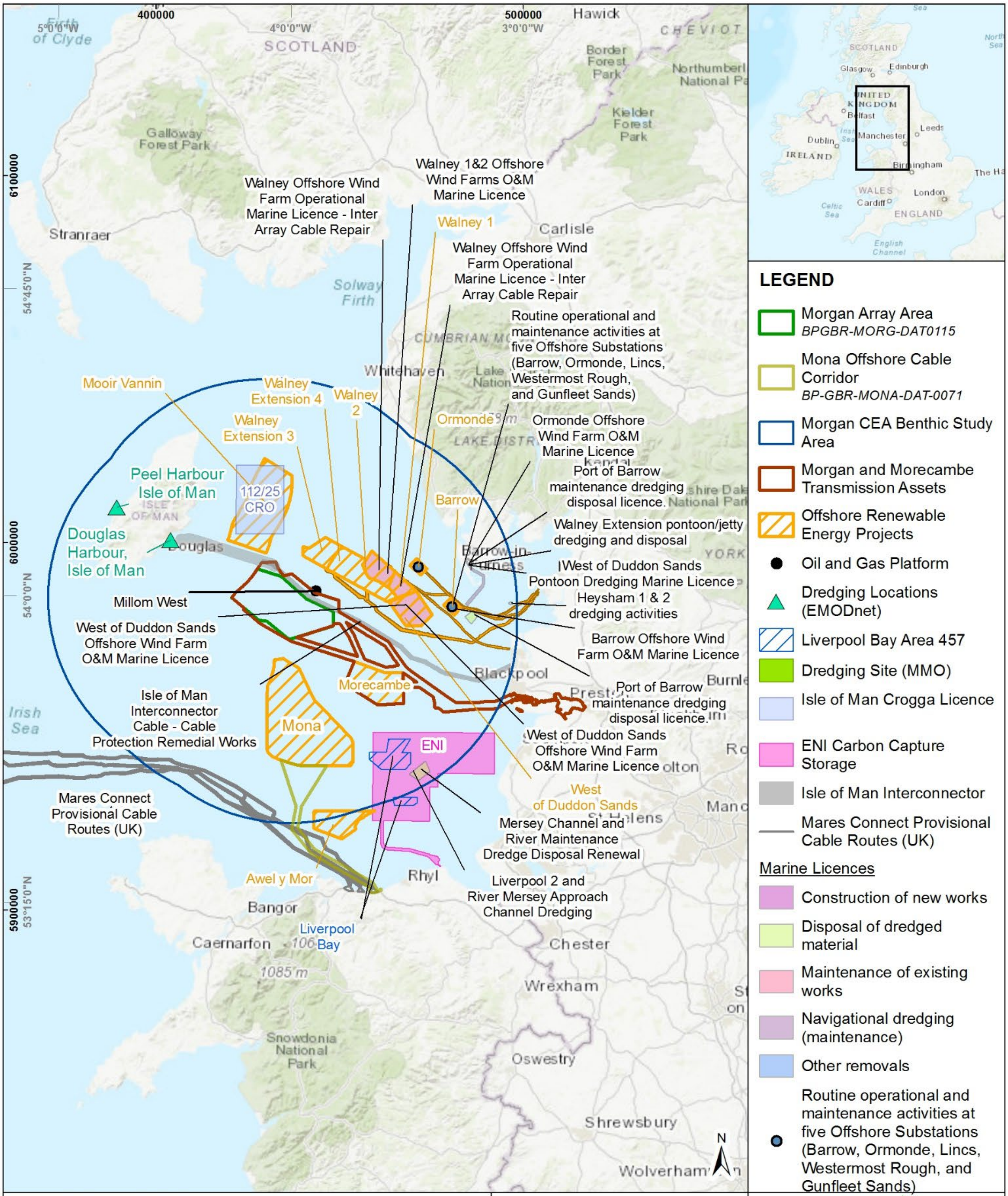
MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Project/Plan	Status	Distance from the Morgan Generation Assets (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Morgan Generation Assets
Mersey channel and river maintenance dredge disposal renewal (MLA/2021/00202)	Operational (with ongoing activities)	44.5	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 Mersey Estuary for all river users.	n/a	2021 to 2031	Dredging and disposal activities associated with this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Liverpool 2 and River Mersey Approach Channel Dredging	Operational (with ongoing activities)	44.5	Capital dredging in front of the proposed terminal to create a berth pocket.	n/a	2019 to 2028	The operations and maintenance activities associated with this project will overlap with the construction phase of the Morgan Generation Assets.
Heysham 1 and 2 dredging activities	Operational (with ongoing activities)	47.9	Maintenance at cooling water outflows for nuclear power station. Dredging of up to 150,000 m^3 silt and 6000,000 m^3 sand. Disposal of up to 28,000 m^3 per year.	n/a	2019 to 2029	The operations and maintenance activities associated with this project will overlap with the construction phase of the Morgan Generation Assets.
Remedial works						
Isle of Man to UK Interconnector Cable - maintenance and repair (MLA/2016/00211)	Operational	0.3	This licence is for depositing additional armouring or protection whilst carrying out contingency repair and maintenance works on the Isle of Man interconnector cable.	n/a	2018 to 2033	Maintenance activities associated with this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Isle of Man Interconnector Cable - Cable Protection	Operational	80.0	Maintenance works on the Isle of Man Interconnector cable protection.	n/a	2014 to 2065	Project operational phase overlaps with the Morgan Generation Assets construction and

Project/Plan	Status	Distance from the Morgan Generation Assets (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Morgan Generation Assets
Remedial Works (MLA/2014/00201)						operations and maintenance phases.
Tier 2						
Offshore renewables projects						
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Pre-application	0.0	Morgan and Morecambe Offshore Wind Farms: Transmission Assets	2028 to 2029	2030 to 2065	Project construction phase overlaps with Morgan and Morecambe Offshore Wind Farms: Transmission Assets construction phase.
Mooir Vannin Offshore Windfarm	Pre-application	2.6	Orsted have signed an agreement for lease to develop a 700 MW (annual output 3,000 GWh) wind farm on the east coast and have undertaken initial surveys since 2016.	2030 to 2032	Operational in 2032 with end date unknown	This project will overlap with the operations and maintenance and decommissioning phases of the Morgan Generation Assets.
Morecambe Offshore Windfarm Generation Assets	Pre-application	11.2	Up to 40 wind turbines	2026 to 2028	2029 to 2089	The construction, operations and maintenance and decommissioning phases of this project will overlap with the construction, operations and maintenance and decommissioning phases of the Morgan Generation Assets.
Capture and Storage (CCS)						
Eni Hynet – Carbon CCS Project – offshore	Pre-application (for offshore	31.0	CCS project in the east Irish Sea. Works will include installation of a new cable, a new Douglas CCS platform	Unknown	Unknown	This project will overlap with the construction and operations and

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Project/Plan	Status	Distance from the Morgan Generation Assets (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Morgan Generation Assets
	elements of the project)		and work on the existing Hamilton, Hamilton North and Lennox wellhead platforms.			maintenance phases of the Morgan Generation Assets.
Aggregate and disposal sites						
Liverpool Bay Area 457	Pre-application	34.3	Proposed extraction of 18 million tonnes of aggregate (mainly sand and fine sediment) over 15 years.	n/a	Unknown	Aggregate extraction activities associated with this project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Tier 3						
Cables and pipelines						
MaresConnect – Wales-Ireland Interconnector Cable	Pre-application	48.2	A proposed 750 MW subsea and underground electricity interconnector system linking the existing electricity grids in Ireland and Great Britain.	2025	2027 to 2037	This project will overlap with the construction and operations and maintenance phases of the Morgan Generation Assets.
Isle of Man to UK Interconnector Cable 2	Pre-application	Unknown	A new 70 MW to 100 MW HVAC interconnector to be operational by 2030 between the Isle and Man and northwest England.	2024- 2030	2030 onwards	Project construction phase overlaps with the Morgan Generation Assets construction phase. Project operations and maintenance phase overlaps with the Morgan Generation Assets operations and maintenance phase.



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Data Sources: Client, TCE, EMODnet, MMO, NRW Survey Application P2578_R6143_Rev1

Partners in UK offshore wind

Project Name:
MORGAN OFFSHORE WIND PROJECT

0 5 10 20 nm
0 5 10 20 30 40 50 km

Drawing Number:
RPSE-MG-ES-BEN-016-04

Drawing Title:
OTHER PROJECTS, PLANS AND ACTIVITIES SCREENED INTO THE CUMULATIVE EFFECTS ASSESSMENT.

Geodetic Information:
Datum: ETRS 1989
Projection: ETRS 1989 UTM Zone 30N
Scale@160mmx220mm: 1:1,750,000

VER	DATE	DETAILS	BY	CHECK
00	23/10/23	First Issue	MJ	TH
04	16/02/24	Revision	NG	TH

Figure 2.6: Other projects, plans and activities screened into the CEA.

2.10.2 Maximum design scenario

2.10.2.1 The MDSs identified in Table 2.27 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. The cumulative effects presented and assessed in this section have been selected from the Project Design Envelope provided in Volume 1, Chapter 3: Project description of the Environmental Statement as well as the information available on other projects and plans, to inform an MDS. 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 wind turbine layout), to that assessed here, be taken forward in the final design scheme.

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Table 2.27: MDS considered for the assessment of potential cumulative effects on benthic subtidal ecology.

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

Potential cumulative effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
Temporary habitat disturbance/loss	✓	×	×	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Offshore Windfarm projects: – Mona Offshore Wind Project construction phase – Walney Extension Offshore Wind Farm operations and maintenance phase – Walney 2 Offshore Wind Farm operations and maintenance phase – Walney 2 Offshore Wind Farm – operations and maintenance marine licences (MLA/2017/00429/1) – West of Duddon Sands Offshore Wind Farm operations and maintenance phase – West of Duddon Sands Offshore Wind Farm operations and maintenance marine licence (MLA/2016/00150/3)	These projects all involve activities which will result in temporary habitat disturbance/loss which may contribute to the impact upon a habitat that the Morgan Generation Assets will also affect.

Potential cumulative effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Walney 1 Offshore Wind Farm operations and maintenance phase – 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) – Ormonde Offshore Wind Farm operations and maintenance phase – Ormonde Offshore Wind Farm – operations and maintenance marine licences (MLA/2015/00086/2 and MLA/2016/00224/2) – Barrow Offshore Wind Farm operations and maintenance and decommissioning phases – Barrow Offshore Wind Farm – operations and maintenance marine licences (MLA/2015/00077 and MLA/2016/00149/3) – Awel y Môr Offshore Wind Farm construction phase – Routine operations and maintenance activities at five OSPs (Barrow, Ormonde, Lincs, Westermost Rough, and Gunfleet Sands). • Oil and gas projects: – Millom West Platform – decommissioning • Dredging projects: – Douglas Harbour, Isle of Man – Port of Barrow maintenance dredging disposal licence – Walney Extension pontoon/jetty dredging and disposal – West of Duddon Sands pontoon dredging marine licence – Maintenance dredging Peel Harbour Isle of Man – Mersey channel and river maintenance dredge disposal renewal – Liverpool 2 and River Mersey approach channel dredging – Heysham 1 and 2 dredging activities • Remedial works	

Potential cumulative effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Isle of Man to UK Interconnector Cable - maintenance and repair (MLA/2016/00211 and MLA/2014/00201/2). **Tier 2** • Tier 1 projects • Offshore windfarm projects: – Morecambe Offshore Windfarm Generation Assets construction and operations and maintenance phases • CCS projects: – Eni Hynet CCS construction and operations and maintenance phases. • Aggregate extraction activities – Liverpool Bay area 457 aggregate extraction site. **Tier 3** • Tier 1 and 2 projects. • Cables and pipelines: – MaresConnect construction and operations and maintenance – Isle of Man Interconnector Cable 2 construction.	
	×	✓	×	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and	These projects all involve activities which will result in temporary habitat disturbance/loss which may contribute to the impact upon a habitat that the Morgan Generation Assets will also affect.

Potential cumulative effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
				Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Offshore Windfarm projects: – – Offshore Wind Project operations and maintenance phase – Walney Extension Offshore Wind Farm operations and maintenance and decommissioning phases – Walney 2 Offshore Wind Farm operations and maintenance and decommissioning phases – Walney 2 Offshore Wind farm – operations and maintenance marine licences (MLA/2017/00429/1) – West of Duddon Sands Offshore Wind Farm operations and maintenance and decommissioning phases – West of Duddon Sands Offshore Wind Farm operations and maintenance marine licence (MLA/2016/00150/3) – Walney 1 Offshore Wind Farm operations and maintenance and decommissioning phases – 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) – Ormonde Offshore Wind Farm operations and maintenance and decommissioning phases – Ormonde Offshore Wind farm – operations and maintenance marine licences (MLA/2015/00086/2 and MLA/2016/00224/2) – Awel y Môr Offshore Wind Farm operations and maintenance and decommissioning phases – Routine operations and maintenance activities at five Offshore Substations (Barrow, Ormonde, Lincs, Westermost Rough, and Gunfleet Sands) • Oil and as projects:	

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

<table>
<tr><th rowspan="2">Potential cumulative effect</th><th colspan="3">Phase</th><th rowspan="2">Maximum Design Scenario</th><th rowspan="2">Justification</th></tr>
<tr><th>C</th><th>O</th><th>D</th></tr>
<tr><td></td><td></td><td></td><td></td><td>– Millom West Platform- decommissioning
• Dredging projects:
– Douglas Harbour, Isle of Man
– Maintenance dredging Peel Harbour Isle of Man
– Mersey channel and river maintenance dredge disposal renewal
• Remedial works
– Isle of Man to UK Interconnector Cable - maintenance and repair (MLA/2016/00211 and MLA/2014/00201/2).
Tier 2
• Tier 1 projects
• Offshore windfarm projects:
– Mooir Vannin Offshore Windfarm construction and operations and maintenance phases
– Morecambe Offshore Windfarm Generation Assets operations and maintenance phase.
• CCS projects:
– Eni Hynet CCS operations and maintenance phase.
Tier 3
• Tier 1 and 2 projects
• Cables/pipelines:
– MaresConnect operations and maintenance phase
– Isle of Man Interconnector Cable 2 operation and maintenance phase.</td><td></td></tr>
<tr><td></td><td>×</td><td>×</td><td>✓</td><td>Scenario 1
Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets.
Scenario 2</td><td>These projects all involve activities which will result in temporary habitat disturbance/loss which may contribute to the impact upon a habitat that the Morgan Generation Assets will also affect.</td></tr>
</table>

Potential cumulative effect	Phase C	Phase O	Phase D	Maximum Design Scenario	Justification
				Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Offshore windfarm projects: – Mona Offshore Wind Project decommissioning phase. **Tier 2** • Tier 1 projects • Offshore windfarm projects: – Mooir Vannin Offshore Windfarm operations and maintenance phase – Morecambe Offshore Windfarm Generation Assets operations and maintenance phase.	
Increase in SSC and associated deposition	✓	×	×	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets.	Outcome of the CEA will be greatest when the greatest number of other schemes are considered in combination. This includes schemes and developments within the CEA study area to capture the potential overlap of impacts during the construction, operations and maintenance and decommissioning phases. Activities from schemes that potentially increase SSC during the temporal overlap with the Morgan Generation Assets phases have been included as these may create a cumulative impact on benthic subtidal ecology receptors.

Potential cumulative effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
				Scenario 3 Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Construction of Mona Offshore Wind Project • Maintenance of Isle of Man to UK Interconnector Cable • Maintenance of Walney Extension 3 offshore wind farm • Maintenance of Walney Extension 4 offshore wind farm • Maintenance of Walney 2 offshore wind farm • Maintenance of West of Duddon Sands offshore wind farm • Maintenance of Walney 1 offshore wind farm • Maintenance of Ormonde offshore wind farm • Maintenance of Barrow offshore wind farm. • Disposal of Douglas Harbour Dredging material at Douglas Head Disposal Site. **Tier 2** • Tier 1 projects • Construction of Morecambe Offshore Windfarm Generation Assets. **Tier 3** **Construction Phase** • Tier 1 and Tier 2 Projects • Construction of the Isle of Man to UK Interconnector 2.	

Potential cumulative effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
	✗	✓	✗	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Operations and maintenance of Mona Offshore Wind Project • Maintenance of Isle of Man to UK Interconnector Cable • Maintenance and decommissioning of Walney Extension 3 offshore wind farm • Maintenance and decommissioning of Walney Extension 4 offshore wind farm • Maintenance and decommissioning of Walney 2 offshore wind farm • Maintenance and decommissioning of West of Duddon Sands offshore wind farm • Maintenance and decommissioning of Walney 1 offshore wind farm • Maintenance and decommissioning of Ormonde offshore wind farm • Maintenance and decommissioning of Barrow offshore wind farm. **Tier 2** • Tier 1 projects	Outcome of the CEA will be greatest when the greatest number of other schemes are considered in combination. This includes schemes and developments within the CEA study area to capture the potential overlap of impacts during the construction, operations and maintenance and decommissioning phases. Activities from schemes that potentially increase SSC during the temporal overlap with the Morgan Generation Assets phases have been included as these may create a cumulative impact on benthic subtidal ecology receptors.

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Potential cumulative effect	Phase C	Phase O	Phase D	Maximum Design Scenario	Justification
				• Operations and maintenance of Morecambe Offshore Windfarm Generation Assets • Operations and maintenance of Morgan and Morecambe Offshore Windfarms Transmission Assets • Construction and operations and maintenance of Mooir Vannin Offshore Wind Farm.	
	×	×	✓	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Mona Offshore Wind Project decommissioning phase . **Tier 2** • Morecambe Offshore Windfarm Generation Assets decommissioning phase • Morgan and Morecambe Offshore Windfarms Transmission Assets decommissioning.	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 construction, operations and maintenance and decommissioning phases. Activities from schemes that potentially impact the tidal/ wave regime and sediment transport during the temporal overlap with the Morgan Generation Assets phases have been included as these may create a cumulative impact on benthic subtidal ecology receptors.

Potential cumulative effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
Long term habitat loss	✓	✓	×	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Offshore windfarm projects: – Awel y Môr Offshore Wind Farm operations and maintenance phase – Mona Offshore Wind Project construction and operations and maintenance phases. • Oil and Gas projects: – Isle of Man Crogga Licence **Tier 2** • Tier 1 projects • Offshore windfarm projects: – Mooir Vannin Offshore Windfarm construction and operations and maintenance phases – Morecambe Offshore Windfarm Generation Assets construction and operations and maintenance phases. • CCS projects:	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 ecology study area meaning they may also affect habitats that the Morgan Generation Assets will also affect.

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Potential cumulative effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Eni Hynet CCS. **Tier 3** • Tier 1 and 2 projects • Cables and pipelines: – MaresConnect construction and operations and maintenance phases – Isle of Man Interconnector Cable 2 construction phase.	
	×	×	✓	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Offshore windfarm projects: – Mona Offshore Wind Project **Tier 2** • Tier 1 projects • Offshore windfarm projects: – Mooir Vannin Offshore Windfarm operations and maintenance phase	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 ecology study area meaning they may also affect habitats that the Morgan Generation Assets will also affect.

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Potential cumulative effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Morecambe Offshore Windfarm Generation Assets decommissioning phase.	
Colonisation of hard substrates	✓	✓	×	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Offshore windfarm projects: – Mona Offshore Wind Project construction and operations and maintenance phase – Awel y Môr Offshore Wind Farm operations and maintenance phase • Oil and Gas projects: – Isle of Man Crogga Licence **Tier 2** • Tier 1 projects • Offshore windfarm projects: – Mooir Vannin Offshore Windfarm construction and operations and maintenance phases	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 ecology study area meaning they may also affect habitats that the Morgan Generation Assets will also affect.

Potential cumulative effect	Phase C	Phase O	Phase D	Maximum Design Scenario	Justification
				– Morecambe Offshore Windfarm Generation Assets construction and operations and maintenance phases. • CCS projects: – Eni Hynet CCS. **Tier 3** • Tier 1 and 2 projects • Cables/pipelines: – MaresConnect construction and operations and maintenance phase – Isle of Man Interconnector Cable 2 construction phase.	
	×	×	✓	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Offshore windfarm projects: – Mona Offshore Wind Project decommissioning phase. **Tier 2** • Tier 1 projects	These projects will all result in the permanent placement of hard structures on the seabed which could be colonised by new communities within the CEA benthic subtidal ecology study area meaning they may also affect habitats that the Morgan Generation Assets will also affect.

Potential cumulative effect	Phase C	Phase O	Phase D	Maximum Design Scenario	Justification
				• Offshore windfarm projects: – Mooir Vannin Offshore Windfarm operations and maintenance phase – Morecambe Offshore Windfarm Generation Assets decommissioning phase.	
Increased risk of introduction and spread of INNS	✓	×	×	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Offshore Windfarm projects: – Mona Offshore Wind Project construction phase – Awel y Môr Offshore Wind Farm construction phase • Oil and Gas: – Isle of Man Crogga Licence **Tier 2** • Tier 1 projects • Offshore windfarm projects:	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 ecology study area meaning they may also affect habitats that the Morgan Generation Assets will also affect.

Potential cumulative effect	Phase C	Phase O	Phase D	Maximum Design Scenario	Justification
				– Morecambe Offshore Windfarm Generation Assets construction phase • CCS projects: – Eni Hynet CCS. **Tier 3** • Tier 1 and 2 projects • Cables/pipelines: – MaresConnect construction and operations and maintenance phases – Isle of Man Interconnector Cable 2 construction phase.	
	×	✓	×	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Offshore Windfarm projects: – Mona Offshore Wind Project operations and maintenance phase – Awel y Môr Offshore Wind Farm operations and maintenance and decommissioning phases.	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 ecology study area meaning they may also affect habitats that the Morgan Generation Assets will also affect.

<table>
<tr><th rowspan="2">Potential cumulative effect</th><th colspan="3">Phase</th><th rowspan="2">Maximum Design Scenario</th><th rowspan="2">Justification</th></tr>
<tr><th>C</th><th>O</th><th>D</th></tr>
<tr><td></td><td></td><td></td><td></td><td>• Oil and Gas projects:
– Isle of Man Crogga Licence.
Tier 2
• Offshore windfarm projects:
– Mooir Vannin Offshore Windfarm construction and operations and maintenance phases
– Morecambe Offshore Windfarm Generation Assets operations and maintenance phase
• CCS projects:
– Eni Hynet CCS.
Tier 3
• Tier 1 projects
• Cables/pipelines:
– MaresConnect operations and maintenance phase
– Isle of Man Interconnector Cable 2 construction phase.</td><td></td></tr>
<tr><td></td><td>×</td><td>×</td><td>✓</td><td>Scenario 1
Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets.
Scenario 2
Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets.
Scenario 3
Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans:</td><td>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 ecology study area meaning they may also affect habitats that the Morgan Generation Assets will also affect.</td></tr>
</table>

Potential cumulative effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
				Tier 1 • Offshore windfarm projects: – Mona Offshore Wind Project decommissioning phase. **Tier 2** • Tier 1 projects • Offshore windfarm projects: – Mooir Vannin Offshore Windfarm operations and maintenance phase – Morecambe Offshore Windfarm Generation Assets decommissioning phase.	
Removal of hard substrate	✗	✗	✓	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Offshore windfarm projects: – Mona Offshore Wind Project decommissioning phase. **Tier 2** • Offshore windfarm projects:	These projects will also undergo the removal of hard substrate within the period of decommissioning for the Morgan Generation Assets.

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Potential cumulative effect	Phase C	Phase O	Phase D	Maximum Design Scenario	Justification
				– Morecambe Offshore Windfarm Generation Assets decommissioning phase.	
Changes in physical processes.	✓	×	×	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Offshore windfarm projects: – Construction of Mona Offshore Wind Project – Decommissioning of Millom West offshore platform. **Tier 2** • Offshore windfarm projects: – Construction of Morecambe Offshore Windfarm Generation Assets.	Outcome of the CEA will be greatest when the greatest number of other schemes are considered in combination. It includes schemes and developments within the CEA study area to capture the potential overlap of impacts during the operations and maintenance phase. Activities from schemes that potentially impact the tidal/ wave regime and sediment transport during the temporal overlap with the Morgan Generation Assets phases have been included as these may create a cumulative impact on benthic subtidal ecology receptors.
	×	✓	×	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets.	

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Potential cumulative effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
				Scenario 2 Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets. **Scenario 3** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans: **Tier 1** • Offshore windfarm projects: – Operations and maintenance of Mona Offshore Wind Project – **Tier 2** • Offshore windfarm projects: – Operations and maintenance of Morecambe Offshore Windfarm: Generation Assets – Operations and maintenance of Morgan and Morecambe Offshore Windfarms Transmission Assets – Construction and operations and maintenance of Mooir Vannin Offshore Wind Farm.	
	×	×	✓	**Scenario 1** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. **Scenario 2** Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and	

<table>
<tr><th rowspan="2">Potential cumulative effect</th><th colspan="3">Phase</th><th rowspan="2">Maximum Design Scenario</th><th rowspan="2">Justification</th></tr>
<tr><th>C</th><th>O</th><th>D</th></tr>
<tr><td></td><td></td><td></td><td></td><td>Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm: Generation Assets.
Scenario 3
Maximum design scenario as described for the Morgan Generation Assets (Table 2.16) assessed cumulatively with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the following other projects/plans:
Tier 1
• Offshore windfarm projects:
– Mona Offshore Wind Project residual structures.
Tier 2
• Offshore windfarm projects:
– Morecambe Offshore Windfarm Generation Assets residual structures
– Morgan and Morecambe Offshore Windfarms Transmission Assets residual structures.</td><td></td></tr>
</table>

2.11 Cumulative effects assessment

2.11.1 Overview

2.11.1.1 A description of the significance of cumulative effects upon benthic subtidal ecology receptors arising from each identified impact is given below.

2.11.1.2 The CEA for the Morgan Generation Assets is presented in a series of tables (one for each potential cumulative impact).

2.11.2 Temporary habitat disturbance/loss

2.11.2.1 There is the potential for cumulative temporary habitat loss as a result of construction activities associated with the Morgan Generation 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 (see Figure 2.6). For the purposes of this Environmental Statement, this additive impact has been assessed within the CEA benthic subtidal ecology study area, defined as the area within a 50 km buffer of the Morgan Generation Assets, using the tiered approach outlined above in section 2.10. The 50 km buffer area captures a fair representation of benthic habitats within the Morgan CEA benthic subtidal ecology study area in proximity to the Morgan Generation Assets.

2.11.2.2 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). One Tier 2 project (Morecambe Offshore Windfarm Generation Assets) and two Tier 3 projects (MaresConnect and the Isle of Man to UK Interconnector cable 2) have been identified within the CEA benthic subtidal ecology study area.

2.11.2.3 A summary of the cumulative of temporary habitat disturbance/loss has been presented in Table 2.28.

2.11.2.4 A cumulative effects assessment for temporary habitat disturbance/loss including detail regarding the temporary habitat disturbance/loss associated with each project can be found in Appendix A.1.

Table 2.28: Cumulative temporary habitat disturbance/loss.

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
Construction			
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Morgan Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. These two projects may result in up to 125.45 km^2 of temporary habitat disturbance/loss. 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**.	The cumulative effects assessment for Scenario 2 considers the following: • The Morgan Generation Assets • Morecambe Offshore Windfarm Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. These three projects may result in up to 128.91 km^2 of temporary habitat disturbance/loss. 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**.	The cumulative effects assessment for Scenario 3 considers Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1, Tier 2 and Tier 3 projects outlined below. **Tier 1** Tier 1 includes a number of renewable energy projects including: • Mona Offshore Wind Project • Awel y Môr Offshore Windfarm • Barrow Offshore Windfarm • Ormonde Offshore Windfarm • Walney 1 Offshore Windfarm • Walney 2 Offshore Windfarm • Walney extension Offshore Windfarm • West of Duddon Sands Offshore Windfarm. Tier 1 projects also include various dredge sites, the decommissioning of an oil and gas platform and cable remedial work (Table 2.27). The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 projects may result in up to 202.23 km^2 of temporary habitat disturbance/loss.

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			The cumulative effect is predicted to be of regional 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**. **Tier 2** Tier 2 includes a number of renewable energy projects including: • Morecambe Offshore Windfarm Generation Assets • Eni Hynet CCS. Additionally Tier 2 includes one aggregate extraction site, Liverpool Bay area 457. Tier 2 also includes all the projects previously described in Tier 1. The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 and Tier 2 projects may result in up to 208.93 km^2 of temporary habitat disturbance/loss. The cumulative effect is predicted to be of regional 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**. **Tier 3** As described in section 2.11.2, there are two projects in Tier 3. One of which is the

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			MaresConnect cable project. 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 Morgan Generation Assets construction phase. 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, 2030). The seabed disturbance associated with these projects is likely to be similar in both nature and magnitude to that arising from the installation of inter-array and interconnector cables for the Morgan Generation Assets. 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. The cumulative effect is predicted to be of regional 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**.
Sensitivity of receptor	The sensitivity of the subtidal IEFs is as described in paragraph 2.9.2.13 to 2.9.2.15 and Table 2.19. The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**. The seapens and burrowing megafauna communities IEF is deemed to be of high to low vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).		

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
Significance of effect	Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the construction phase 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 2.6.2 and the matrix in Table 2.15, 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 2.9.2.12 to 2.9.2.20, 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.	Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the construction phase 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 2.6.2 and the matrix in Table 2.15, 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 2.9.2.12 to 2.9.2.20, 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.	**Tier 1** Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the construction phase 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 2.6.2 and the matrix in Table 2.15, 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 2.9.2.12 to 2.9.2.20, 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. **Tier 2** Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the construction phase 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 2.6.2 and the matrix in Table 2.15, 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 2.9.2.12 to 2.9.2.20, 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. **Tier 3** Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the construction phase 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 2.6.2 and the matrix in Table 2.15, this

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			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 2.9.2.12 to 2.9.2.20, 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.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures are proposed.		
Operations and maintenance			
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Morgan Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. These two projects may result in up to 21.62 km^2 of temporary habitat disturbance/loss. 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**.	The cumulative effects assessment for Scenario 2 considers the following: • The Morgan Generation Assets • Morecambe Offshore Windfarm Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. These three projects may result in up to 21.78 km^2 of temporary habitat disturbance/loss. The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the	The cumulative effects assessment for Scenario 3 considers Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1, Tier 2 and Tier 3 projects outlined below. **Tier 1** Tier 1 includes a number of renewable energy projects including: • Mona Offshore Wind Project • Awel y Môr Offshore Windfarm • Barrow Offshore Windfarm • Ormonde Offshore Windfarm • Walney 1 Offshore Windfarm

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
		impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	• Walney 2 Offshore Windfarm • Walney extension Offshore Windfarm • West of Duddon Sands Offshore Windfarm. Tier 1 projects also include various dredge sites, the decommissioning of an oil and gas platform and cable remedial work (Table 2.27). The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 projects may result in up to 58.76 km^2 of temporary habitat disturbance/loss. The cumulative effect is predicted to be of regional 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**. **Tier 2** Tier 2 includes a number of renewable energy projects including: • Mooir Vannin Offshore Windfarm • Morecambe Offshore Windfarm Generation Assets • Eni Hynet CCS. Additionally Tier 2 includes one aggregate extraction site, Liverpool Bay area 457. Tier 2 also includes all the projects previously described in Tier 1. The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			Assets together with the Tier 1 and Tier 2 projects may result in up to 62.16 m^2 of temporary habitat disturbance/loss. The cumulative effect is predicted to be of regional 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**. **Tier 3** As described in section 2.11.2, there are two projects in Tier 3. One of which is the MaresConnect cable project. 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 in the operation and maintenance phase during the Morgan Generation Assets operation and maintenance phase. There is currently very limited information available on this project however it is understood that the project is likely to be operational from 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 maintenance (i.e. repair and reburial) of the inter-array and interconnectors cables for the Morgan Generation Assets. 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.

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			The cumulative effect is predicted to be of regional 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**.
Sensitivity of receptor	The sensitivity of the receptors remains the same as the construction phase.		
Significance of effect	Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the operations and maintenance phase 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 significant in EIA terms.	Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the operations and maintenance phase 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 significant in EIA terms.	**Tier 1** Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the operations and maintenance phase 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 significant in EIA terms. **Tier 2** Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the operations and maintenance phase is deemed to be low and the

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
			sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is significant in EIA terms. **Tier 3** Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the operations and maintenance phase 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 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.		
Decommissioning			
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Morgan Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. The extent of temporary habitat disturbance/loss for both of these projects is	The cumulative effects assessment for Scenario 2 considers the following: • The Morgan Generation Assets • Morecambe Offshore Windfarm Generation Assets	The cumulative effects assessment for Scenario 3 considers Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1, Tier 2 and Tier 3 projects outlined below. **Tier 1** Tier 1 includes the following projects:

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	likely to be similar to the construction phase. 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**.	• Morgan and Morecambe Offshore Wind Farms: Transmission Assets. The extent of temporary habitat disturbance/loss for these projects is likely to be similar to the construction phase. 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**.	• Mona Offshore Wind Project. The impact of the Mona Offshore Wind Project has not been quantified however it is stated that is it expected to be similar to the construction phase of the project (Mona Offshore Wind Ltd., 2024). The cumulative effect is predicted to be of regional 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**. **Tier 2** This phase includes three renewable energy projects: • Mooir Vannin Offshore Windfarm • Morecambe Offshore Windfarm Generation Assets. The magnitude of the cumulative impacts for the Tier 2 projects in the decommissioning phase is likely to be similar to what has been described in the construction phase but slightly reduced as activities such as seabed preparation would not be taking place. The cumulative effect is predicted to be of regional 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 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			Tier 3 There are no Tier 3 projects active in this phase of the Morgan Generation Assets.
Sensitivity of receptor	The sensitivity of the receptors remains the same as the construction phase.		
Significance of effect	Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the decommissioning phase 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 significant in EIA terms.	Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the decommissioning phase 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 significant in EIA terms.	**Tier 1** Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the operations and maintenance phase 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 significant in EIA terms. **Tier 2** Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the operations and

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			maintenance phase 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 significant in EIA terms. **Tier 3** N/A
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures are proposed.		

2.11.3 Increase in suspended sediment concentrations and associated deposition

2.11.3.1 Increased SSC may arise due to seabed preparation involving sandwave clearance, the installation of the wind turbines and OSP foundations, the installation and/or maintenance of cables and associated decommissioning activities. Should the other projects cited take place concurrently with the Morgan Generation Assets (construction, operations and maintenance or decommissioning), there is potential for cumulative increased turbidity levels.

Table 2.29: Cumulative assessment of the increase in SSC and associated deposition impact.

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
Construction			
Magnitude of impact	The construction phase of the Morgan and Morecambe Offshore Wind Farms: Transmission Assets includes activities which will give rise to increased SSC namely, site preparation/ sandwave clearance, export and interconnector cable trenching and potentially drilling of piles for OSPs. Noting that the OSPs and interconnector installation for Morgan Generation Assets have been included within the assessment presented in section 2.9.3. The site preparation and offshore export cable installation will be undertaken in close proximity to the Morgan Generation Assets using similar parameters and techniques to those associated with the inter-array cable installation therefore a negligible amount of remobilised and redistributed material may reach the south edges of the West of Copeland MCZ and the West of Walney MCZ. 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 from all activities. However, should multiple operations be	The Morecambe Offshore Windfarm Generation Assets includes activities which will give rise to increased SSC namely, site preparation/sandwave clearance, inter-array cable trenching and potential drilling of piles for wind turbines. Due to the location of the Morecambe Generation Assets further south and also to the east of the Morgan Generation Assets, the tidal flows orientated in a north south direction therefore there are no additional cumulative effects from Scenario 1 in relation to the West of Copeland MCZ and the West of Walney MCZ. The cumulative effect on the subtidal habitat IEFs 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**. The cumulative effect on the West of Walney MCZ IEFs 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 cumulative effect on the West of Copeland MCZ IEFs is predicted to be of local spatial extent, short term duration, intermittent and high	**Tier 1** The construction phase of Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets would coincide with the construction phase of Mona Offshore Wind Project. The Mona Offshore Wind Project is located >10 km to the south of Morgan Generation Assets and Transmission Assets, where tidal flows are at an east to west orientation and therefore cumulative impact on SSC, particularly with respect to the receptors, would not occur. The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets construction phase coincides with the maintenance phases of a number of offshore energy projects. In each case the activities which are associated with increased SSC relate to cable maintenance and reburial and, as such, would be of similar magnitude and extent as those associated with the Morgan Generation Assets operations and maintenance phase and be intermittent in nature. The route of the Isle of Man Interconnector cable is immediately adjacent to the north extent of the Morgan Generation Assets and intersects with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets, therefore if work is

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	undertaken plumes would be advected on the tide and not towards one another. In the case of export cables and inter-array cables these plumes may interact however 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 on the subtidal habitat IEFs 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**. The cumulative effect on the West of Walney MCZ IEFs 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 cumulative effect on the West of Copeland MCZ IEFs is predicted to be of local spatial extent, medium term duration, intermittent and medium reversibility. It is	reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible.**	undertaken co-incidentally in these areas sediment plumes may coalesce and a negligible amount of material may reach the south edges of the West of Copeland MCZ and the West of Walney MCZ. The Walney Offshore Windfarm (all areas) and the West of Duddon Sands Offshore Windfarm are located approximately 10 km to the north of the Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets. If reburial is undertaken to the south of these sites, the plume extent may reach Morgan Generation Assets. It is noted that sediment plumes would be carried in concert with the tide, and not towards one another and activities are associated with repair and reburial cables and would be characterised by short term intermittent mobilisation of sediment along relatively short sections of cable. In addition to these offshore windfarms, Ormonde Offshore Windfarms is located within the West of Copeland MCZ and the West of Walney MCZ designated receptors. So, although any potential contribution from Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets would be negligible, the offshore windfarm maintenance activities would directly impact the receptors. The Barrow Offshore Windfarm is located on the east extent of the CEA physical processes study area and due to distance and orientation, would not introduce cumulative impacts with Morgan

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible.**		Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets with respect to the West of Copeland MCZ and the West of Walney MCZ designated receptors. With regards to the disposal site associated with the dredging operations at Douglas Harbour, the distance and the orientation of tidal currents are such that this project would not exhibit a cumulative effect with the Morgan Generation Assets and Transmission Assets with respect to the West of Copeland MCZ and the West of Walney MCZ. With suspended sediment plumes running in parallel instead of coalescing. The cumulative effect on the subtidal habitat IEFs 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**. The cumulative effect on the West of Walney MCZ IEFs 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 cumulative effect on the West of Copeland MCZ IEFs 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 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			Tier 2 The construction of the Morecambe Generation Assets was assessed under Scenario 2 and concluded there are no additional cumulative effects from Scenario 1 in relation to the West of Copeland MCZ and the West of Walney MCZ. The cumulative effect on the subtidal habitat IEFs 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**. The cumulative effect on the West of Walney MCZ IEFs 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 cumulative effect on the West of Copeland MCZ IEFs 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.** **Tier 3** The construction of a second interconnector cable between the Isle of Man and the UK may occur during the construction phase of the Morgan Generation Assets as it is due to be operational in 2030. Interconnector cable installation activities would likely be of similar magnitude and extent as

	Scenario 1 **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
			those associated with the Morgan Generation Assets cable installation operations. Dependent on the detailed design and cable routing associated with the interconnector cable a cumulative impact may arise with the Morgan Generation Assets and Transmission Assets with respect to the West of Copeland MCZ and the West of Walney MCZ. 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. The cumulative effect on the subtidal habitat IEFs 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**. The cumulative effect on the West of Walney MCZ IEFs 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 cumulative effect on the West of Copeland MCZ IEFs 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.**
Sensitivity of receptor	The sensitivity of the subtidal habitat IEFs are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.3.24 to 2.9.3.30 and above in Table 2.19.		

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediments with diverse benthic communities IEF is deemed to be of medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore considered to be **low**. The brittlestar beds IEF is deemed to be of high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore considered to be **medium**. The Annex I low resemblance stony reef (outside an SAC) IEF and the seapens and burrowing megafauna communities IEF are deemed not to be sensitive and of national value. The sensitivity of the receptor is therefore considered to be **negligible.** The sensitivity of the West of Walney MCZ IEFs are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.3.33 to 2.9.3.36 and above in Table 2.19. The seapens and burrowing megafauna communities IEF and subtidal mud IEF and subtidal sand IEF within the West of Walney MCZ are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible.** The sensitivity of the West of Copeland MCZ IEFs are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.3.37 to 2.9.3.39 and above in Table 2.20. The subtidal coarse sediment IEF and subtidal mixed sediment IEF within the West of Copeland MCZ are 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 within the West of Copeland MCZ is deemed not to be sensitive and of national value. The sensitivity of the receptor is therefore, considered to be **negligible**.		
Significance of effect	Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediment with diverse benthic communities IEFs 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 **negligible** significance, which is not significant in EIA terms.	Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediment with diverse benthic communities IEFs 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 **negligible** significance, which is not significant in EIA terms.	**Tier 1, Tier 2 and Tier 3** Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediment with diverse benthic communities IEFs 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 **negligible** significance, which is not significant in EIA terms.

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	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. Overall, for the Annex I low resemblance stony reef (outside an SAC) IEF and the 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 negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF and subtidal mixed sediment IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. The cumulative	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. Overall, for the Annex I low resemblance stony reef (outside an SAC) IEF and the 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 negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF and subtidal mixed sediment IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the cumulative impact	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. Overall, for the Annex I low resemblance stony reef (outside an SAC) IEF and the 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 negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF and subtidal mixed sediment IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.	is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.	the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** 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.		
Operations and maintenance			
Magnitude of impact	The operations and maintenance phase of the Morgan and Morecambe Offshore Wind Farms: Transmission Assets includes cable burial activities which may result in increased SSC. 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 than the construction phases of the Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets.	It is noted that maintenance activities are both intermittent and a smaller scale than that of the construction phase. Additionally, due to the location of the Morecambe Generation Assets further south and to the east of the Morgan Generation Assets there are no additional cumulative effects from Scenario 1 in relation to the West of Copeland MCZ and the West of Walney 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 **negligible**.	**Tier 1** The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets operations and maintenance phase coincides with the operations and maintenance phases of the Mona Offshore Wind Project and the Morecambe Generation Assets. In all cases the magnitude is reduced from that of the construction phases associate with each of the projects due to the limited temporal and spatial nature of repair activities. The operations and maintenance phase of the Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets is associated with cable repair and

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	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**. The cumulative effect on the West of Walney MCZ IEFs 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 cumulative effect on the West of Copeland MCZ IEFs 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 cumulative effect on the West of Walney MCZ IEFs 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 cumulative effect on the West of Copeland MCZ IEFs 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.**	reburial activities. These activities are both intermittent and on a smaller scale than that of the construction phase cable installation therefore the magnitude of the impact is reduced. The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets operations and maintenance phase also coincides with the maintenance phases of the same offshore energy projects identified for the construction phase. Any potential cumulative impacts would be of a lesser magnitude. Noting that Walney (all phases), West of Duddon Sands and Ormonde Offshore Wind Farms are located within the West of Copeland MCZ and the West of Walney MCZ and although any potential contribution from Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets would be negligible, the Offshore Wind Farm maintenance activities associated with the other projects would directly impact the receptors. The cumulative effect on the subtidal habitat IEFs 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 cumulative effect on the West of Walney MCZ IEFs is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			affect the receptor directly. The magnitude is therefore, considered to be **negligible.** The cumulative effect on the West of Copeland MCZ IEFs 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.** **Tier 2** The Mooir Vannin Offshore Wind Farm would be under construction at the commencement of this period and going forward into the operations and maintenance phase following completion. The associated activities would be of limited spatial extent and frequency and unlikely to interact with sediment plumes from the Morgan Generation Assets due to the orientation of the tidal flows and the intermittent nature of all activities. The cumulative effect on the subtidal habitat IEFs 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 cumulative effect on the West of Walney MCZ IEFs 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 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			The cumulative effect on the West of Copeland MCZ IEFs 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.**
Sensitivity of receptor	The sensitivity of the receptors remains the same as the construction phase.		
Significance of effect	Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediment with diverse benthic communities IEFs the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. 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 negligible and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the Annex I low resemblance stony reef (outside an SAC) IEF and the	Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediment with diverse benthic communities IEFs the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. 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 negligible and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the Annex I low resemblance stony reef (outside an SAC) IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is	**Tier 1 and Tier 2** Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediment with diverse benthic communities IEFs the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. 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 negligible and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the Annex I low resemblance stony reef (outside an SAC) IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF and subtidal mixed sediment IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The	considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF and subtidal mixed sediment IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.	be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF and subtidal mixed sediment IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	cumulative effect will, therefore, be of **negligible** 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.		
Decommissioning			
Magnitude of impact	Decommissioning of Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets are on the same projected timeline. In both cases it is proposed that cables will be removed using similar techniques to those applied in the construction phase, with scour protection remaining *in situ*. Decommissioning activity will therefore result in increased SSC however this would be localised and of a lesser magnitude than the construction phase with sandwave clearance and dredging activities being significantly reduced. 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 cumulative effect on the West of Walney MCZ IEFs is predicted to be of local spatial extent, short term duration,	As outlined in the construction phase, the decommissioning of Morecambe Generation Assets, should it occur concurrently with Scenario 1, would not results in any additional impacts on the West of Copeland MCZ or the West of Walney 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 **negligible**. The cumulative effect on the West of Walney MCZ IEFs 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 cumulative effect on the West of Copeland MCZ IEFs is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will	**Tier 1** Decommissioning of Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets are on the same projected timeline as decommissioning of the Mona Offshore Wind Project. It is proposed that cables will be removed using similar techniques to those applied in the construction phase, with scour protection remaining *in situ*. Decommissioning activity will therefore result in increased SSC however this would be localised and of a lesser magnitude than the construction phase with sandwave clearance and dredging activities being significantly reduced. The cumulative effect on the subtidal habitat IEFs 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 cumulative effect on the West of Walney MCZ IEFs is predicted to be of local spatial extent, short term duration, intermittent and high

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible.** The cumulative effect on the West of Copeland MCZ IEFs 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.**	affect the receptor directly. The magnitude is therefore, considered to be **negligible.**	reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible.** The cumulative effect on the West of Copeland MCZ IEFs 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.** **Tier 2** Decommissioning of Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets are on the same projected timeline as decommissioning of Morecambe Generation Assets. In each case it is proposed that cables will be removed using similar techniques to those applied in the construction phase, with scour protection remaining *in situ*. Decommissioning activity will therefore result in increased SSC however this would be localised and of a lesser magnitude than the construction phase with sandwave clearance and dredging activities being significantly reduced. The cumulative effect on the subtidal habitat IEFs 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 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			The cumulative effect on the West of Walney MCZ IEFs 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 cumulative effect on the West of Copeland MCZ IEFs 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.**
Sensitivity of receptor	The sensitivity of the receptors remains the same as the construction phase.		
Significance of effect	Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediment with diverse benthic communities IEFs the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. 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 negligible and the sensitivity	Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediment with diverse benthic communities IEFs the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. 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 negligible and the sensitivity of the receptor is considered to be medium. The cumulative effect	**Tier 1 and 2** Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and the subtidal coarse and mixed sediment with diverse benthic communities IEFs the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. 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 negligible and the sensitivity of the receptor is considered to be medium. The cumulative effect

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	of the receptor is considered to be medium. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the Annex I low resemblance stony reef (outside an SAC) IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF and subtidal mixed sediment IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. The cumulative effect will, therefore, be of **negligible**	will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the Annex I low resemblance stony reef (outside an SAC) IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF and subtidal mixed sediment IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The	will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the Annex I low resemblance stony reef (outside an SAC) IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF, subtidal mud IEF and the seapens and burrowing megafauna communities IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF and subtidal mixed sediment IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be low. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.	cumulative effect will, therefore, be of **negligible** 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.		

2.11.4 Long term habitat loss/habitat alteration

2.11.4.1 Tier 1 cumulative long term habitat loss/habitat alteration is predicted to occur as a result of the presence of the Morgan Generation Assets, Mona Offshore Wind Project and the Awel y Môr Offshore Wind Farm and the Isle of Man Crogga licence; all other offshore wind farms which are operational within the Morgan CEA benthic subtidal ecology study area are considered to be part of the baseline (see Figure 2.6). Long term habitat loss/habitat alteration may result from the physical presence of foundations, scour protection and cable protection.

2.11.4.2 Three Tier 2 projects have been identified within the CEA benthic subtidal ecology study area (Mooir Vannin Offshore Windfarm, the Morecambe Offshore Windfarm Generation Assets and Eni Hynet CCS). Two Tier 3 projects (i.e. MaresConnect and the Isle of Man Interconnector 2) has been identified within the CEA benthic subtidal ecology study area.

2.11.4.3 A full assessment of the cumulative impacts of long term habitat loss/habitat alteration is presented in Table 2.30 below.

Table 2.30: Cumulative long term habitat loss.

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
Construction and operations and maintenance			
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • Morgan Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. The installation of infrastructure for both of these projects would result in up to 2.84 km^2 of long term habitat loss/habitat alteration. This is the result of the installation of infrastructure described in the construction and operations and maintenance phases of section 2.9.5 as well as the cable protection, scour protection and OSP foundations associated with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets resulting in 1.53 km^2 of long term habitat loss/habitat alteration (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023). 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 2 considers the following: • Morgan Generation Assets • Morecambe Offshore Windfarm Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. The installation of infrastructure for these three projects would result in up to 3.29 km^2 of long term habitat loss/habitat alteration. This is the result of the installation of infrastructure described in the construction and operations and maintenance phases of section 2.9.5 as well as 1.53 km^2 of long term habitat loss/habitat alteration from the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023). Additionally the Morecambe Offshore Windfarm Generation Assets will result in 0.46 km^2 of long term habitat loss/habitat alteration from wind turbine foundations, scour protection and cable protection (Morecambe Offshore Windfarm Ltd., 2023b). 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	The cumulative effects assessment for Scenario 3 considers Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1, Tier 2 and Tier 3 projects outlined below. **Tier 1** The cumulative effects assessment for Tier 1 considers the following: • Mona Offshore Wind Project • Awel y Môr Offshore Windfarm • Crogga oil and gas exploration licence. 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 Wind Farm 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. No quantification regarding the impact of this activity has been

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
		receptor directly. The magnitude is therefore, considered to be **low**.	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 Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 projects may result in up to 6.10 km^2 of long term habitat loss. 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**. **Tier 2** The cumulative effects assessment for Tier 2 considers the following: • Morecambe Offshore Windfarm Generation Assets • Mooir Vannin Offshore Windfarm • 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 from wind turbine foundations and cable and scour protection (Mooir Vannin Offshore Windfarm Ltd, 2023). For the Morecambe Offshore Windfarm Generation Assets the predicted long term

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			habitat loss/habitat alteration may be up to 0.46 km^2, with any long term habitat loss as a result of the presence of/habitat alteration likely to arise under foundation structures and associated scour protection, and under any cable protection (Morecambe Offshore Windfarm Ltd, 2023b). 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 Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 and Tier 2 projects may result in up to 6.56 km^2 of long term habitat loss. 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**. **Tier 3** There are two projects in Tier 3; the MaresConnect cable (MaresConnect, 2022) and the Isle fo Man to UK Interconnector 2Manx Utilities, 2023). There is currently no information on the impact that these cable projectss will have on benthic ecology receptors however the infrastructure

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			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 Morgan Generation Assets (i.e. cable protection and cable crossings). 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. The cumulative effect is predicted to be of regional 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**.
Sensitivity of receptor	The sensitivity of the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.5.9to 2.9.5.12 and in Table 2.21. The subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF are deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore considered to be **high**.		
Significance of effect	Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative long term subtidal habitat loss/habitat alteration impact during the construction and operations and maintenance phases is deemed to be low and the sensitivity	Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative long term subtidal habitat loss/habitat alteration impact during the construction and operations and maintenance phases is deemed to be low and the sensitivity	**Tier 1** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative long term subtidal habitat loss/habitat alteration impact during the construction and operations and maintenance

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is 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 Morgan benthic subtidal ecology study area 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.	of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is 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 Morgan benthic subtidal ecology study area 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.	phases is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is 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 Morgan benthic subtidal ecology study area 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. **Tier 2** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative long term subtidal habitat loss/habitat alteration impact during the construction and operations and maintenance phases is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is 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 Morgan benthic subtidal ecology study area which is unlikely to compromise the integrity of these habitats and communities such that they would not be able

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
			to support their characterising communities or perform their ecosystem function. **Tier 3** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative long term subtidal habitat loss/habitat alteration impact during the construction and operations and maintenance phases is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is 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 Morgan benthic subtidal ecology study area 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 are proposed.		

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
Decommissioning			
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • Morgan Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. The infrastructure remaining on the seabed following the decommissioning of the Morgan Generation assets for both projects would result in up to 2.77 km^2 of permanent habitat loss/habitat alteration. This is the result of infrastructure being left *in situ* as described in the decommissioning phase of section 2.9.5 as well as due to the presence of cable protection and scour protection associated with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets resulting in 1.52 km^2 of permanent habitat loss (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023). The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and irreversible. 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 2 considers the following: • Morgan Generation Assets • Morecambe Offshore Windfarm Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. The infrastructure remaining on the seabed following the decommissioning of the Morgan Generation assets for both projects would result in up to 3.22 km^2 of permanent habitat loss/habitat alteration. This is the result of infrastructure being left *in situ* as described in the decommissioning phase of section 2.9.5 as well as 1.52 km^2 of permanent habitat loss/habitat alteration from the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023). Additionally the Morecambe Offshore Windfarm Generation Assets will result in 0.46 km^2 of long term habitat loss/habitat alteration from wind turbine foundations, scour protection and cable protection (Morecambe Offshore Windfarm Ltd., 2023b). The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and irreversible. 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 Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1, Tier 2 and Tier 3 projects outlined below. **Tier 1** The cumulative effects assessment for Tier 1 considers the following: • 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 Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 projects may result in up to 4.90 km^2 of long term habitat loss. The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Tier 2** The cumulative effects assessment for Tier 2 considers the following:

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			• Mooir Vannin Offshore Windfarm • Morecambe Offshore Windfarm Generation Assets. For the Morecambe Offshore Windfarm Generation Assets the predicted long term habitat loss/habitat alteration may be up to 0.46 km^2, with any long term habitat loss as a result of the presence of/habitat alteration likely to arise under foundation structures and associated scour protection, and under any cable protection (Morecambe Offshore Windfarm Ltd, 2023b). These projects will be in their operations and maintenance and decommissioning phases during the decommissioning phase of the Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets. These projects are likely to leave similar infrastructure *in situ* as the Morgan Generation Assets such as scour and cable protection. The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 and Tier 2 projects may result in up to 5.36 km^2 of long term habitat loss. The cumulative effect is predicted to be of regional spatial extent, long term duration, continuous and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
			Tier 3 There are no Tier 3 projects active during the Morgan Generation Assets decommissioning phase.
Sensitivity of receptor	The sensitivity of the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.5.9 to 2.9.5.12 and in Table 2.21. The subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF are deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore considered to be **high**.		
Significance of effect	Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative permanent habitat loss/habitat alteration impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is significant in EIA terms. The cumulative permanent habitat loss/habitat alteration will only affect a small proportion of the total area of these IEFs in the Morgan benthic subtidal ecology study area which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their characterising	Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative permanent habitat loss/habitat alteration impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is significant in EIA terms. The cumulative permanent habitat loss/habitat alteration will only affect a small proportion of the total area of these IEFs in the Morgan benthic subtidal ecology study area which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their	**Tier 1** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative permanent habitat loss/habitat alteration impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is significant in EIA terms. The cumulative permanent habitat loss/habitat alteration will only affect a small proportion of the total area of these IEFs in the Morgan benthic subtidal ecology study area which is unlikely to compromise the integrity of these habitats and communities such that they would not be able to support their

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
	communities or perform their ecosystem function.	characterising communities or perform their ecosystem function.	characterising communities or perform their ecosystem function. **Tier 2** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative permanent habitat loss/habitat alteration impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is significant in EIA terms. The cumulative permanent habitat loss/habitat alteration will only affect a small proportion of the total area of these IEFs in the Morgan benthic subtidal ecology study area 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 are proposed.		

2.11.5 Introduction of artificial structures

2.11.5.1 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 ecology study area.

2.11.5.2 The three projects which were screened into the Tier 1 assessment for cumulative effects from the introduction of artificial structures with the Morgan Generation Assets are the Mona Offshore Wind Project and Awel y Môr Offshore Windfarm and Isle of Man Crogga licence (see Table 2.27).

2.11.5.3 The only Tier 2 projects which have been identified within the CEA benthic subtidal ecology study area are offshore renewable projects (i.e. Mooir Vannin Offshore Windfarm, Morecambe Offshore Windfarm Generation Assets and Eni Hynet CCS). In Tier 3 there are two projects, the MaresConnect interconnector cable and Isle of Man to UK Interconnector 2.

2.11.5.4 A full assessment of the cumulative impacts of introduction of artificial structures is presented in Table 2.31 below.

Table 2.31: Cumulative introduction of artificial structures.

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
Construction and operations and maintenance			
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • Morgan Generation Assets. • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. The installation of infrastructure for both of these projects would result in up to 3.34 km^2 of artificial structures. This is the result of the installation of infrastructure described in the construction and operations and maintenance phases of section 2.9.6 as well as the cable protection, scour protection and OSP foundations associated with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets resulting in 1.55 km^2 of artificial structures introduced (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023). The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and irreversible. 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 2 considers the following: • Morgan Generation Assets • Morecambe Offshore Windfarm • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. The installation of infrastructure for these projects would result in up to 3.80 km^2 of artificial structures. This is the result of the installation of infrastructure described in the construction and operations and maintenance phases of section 2.9.6 as well as 1.55 km^2 of artificial structures introduced from the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023). Additionally the Morecambe Offshore Windfarm Generation Assets will result in the introduction of up to 0.46 km^2 of artificial structures from wind turbine and OSP foundations and scour and cable protection (Morecambe Offshore Windfarm Ltd., 2023b). The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and irreversible. It is predicted	The cumulative effects assessment for Scenario 3 considers Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1, Tier 2 and Tier 3 projects outlined below. **Tier 1** The cumulative effects assessment for Tier 1 considers the following: • Mona Offshore Wind Project • Awel y Môr Offshore Windfarm • Crogga oil and gas exploration licence. The Mona Offshore Wind Project is likely to result in the introduction of 1.07 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). Both of these projects will be installing and maintaining wind turbine and OSP foundations and scour and cable protection within the Morgan CEA benthic subtidal ecology study area during the construction and operations and maintenance phase of the Morgan Generation Assets.

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
		that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	This tier also includes the Crogga oil and gas exploration licence. 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). The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 projects may result in the introduction of up to 7.10 km^2 of artificial structures. The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Tier 2** The cumulative effects assessment for Tier 2 considers the following: • Mooir Vannin Offshore Windfarm • Morecambe Offshore Windfarm Generation Assets • 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

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			cable and scour protection (Mooir Vannin Offshore Windfarm Ltd, 2023). For the Morecambe Offshore Windfarm Generation Assets up to 0.46 km^2 of artificial structures may be installed arising from foundation structures and associated scour protection, and cable protection (Morecambe Offshore Windfarm Ltd, 2023b). 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 Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 and Tier 2 projects may result in the introduction of up to 7.55 km^2 of artificial structures. The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Tier 3** There are two projects in Tier 3. Both of which are cable projects, MaresConnect and the Isle fo Man to UK Interconnector 2 (MaresConnect, 2022; Manx Utilities, 2023). There is currently no information on the impact of either of these interconnector cables will have on benthic ecology receptors however it is likely that artificial structures will be introduced in relation to the cables may be similar to what is described for cables for the

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			Morgan Generation Assets (i.e. cable protection and cable crossings). The cumulative effect is predicted to be of local spatial extent, long term duration, continuous and irreversible. 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 the subtidal IEF are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.6.12 to 2.9.6.20. All of the subtidal IEFs (the subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF) are deemed to be of high vulnerability, low recoverability, and national value. The sensitivity of the IEFs is therefore, considered to be **high**.		
Significance of effect	Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative introduction of artificial structures impact during the construction and operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be 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	Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative introduction of artificial structures impact during the construction and operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be 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	**Tier 1** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative introduction of artificial structures impact during the construction and operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be 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

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	the impact, the large area over which this potential impact is dispersed.	the impact, the large area over which this potential impact is dispersed.	the impact, the large area over which this potential impact is dispersed. **Tier 2** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative introduction of artificial structures impact during the construction and operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be 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. **Tier 3** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative introduction of artificial structures impact during the construction and operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will,

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
			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 are proposed.		
Decommissioning			
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: - Morgan Generation Assets - Morgan and Morecambe Offshore Wind Farms: Transmission Assets. In the decommissioning phase of the Morgan Generation Assets up to 2.76 km^2 of artificial structures could be left *in stu* from both projects resulting in permanent habitat creation. This is the result of the decommissioning of infrastructure described in section 2.9.6 as well as the scour and cable protection being left *in situ* from the Morgan and Morecambe Offshore Wind Farms: Transmission Assets resulting in 1.50 km^2 of permanent habitat creation (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023). The cumulative effect is predicted to be of local spatial extent, permanent, continuous and irreversible. It is predicted that the impact will	The cumulative effects assessment for Scenario 2 considers the following: - Morgan Generation Assets - Morecambe Offshore Windfarm Generation Assets - Morgan and Morecambe Offshore Wind Farms: Transmission Assets. In the decommissioning phase of the Morgan Generation Assets up to 3.21 km^2 of artificial structures could be left *in stu* from these three projects resulting in permanent habitat creation. This is the result of the decommissioning of infrastructure described in section 2.9.6 as well as 1.50 km^2 of permanent habitat creation from the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023). Additionally up to 0.46 km^2 of artifcial infrastructure will be installed as a	The cumulative effects assessment for Scenario 3 considers Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1, Tier 2 and Tier 3 projects outlined below. **Tier 1** The cumulative effects assessment for Tier 1 considers the following: - Mona Offshore Wind Project. The Mona Offshore Wind project may result in up to 2.14 km^2 of permanent habitat creation. The project may leave scour protection and cable protection *in situ* during its decommissioning phase, which coincides with the Morgan Generation Assets decommissioning phase, resulting in permanent habitat creation. The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 projects may result

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	affect the receptor directly. The magnitude is therefore, considered to be **low**.	result of the Morecambe Offshore Windfarm Generation Assets (Morecambe Offshore Winfarm Ltd., 2023b). The cumulative effect is predicted to be of local spatial extent, permanent, continuous and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	in the introduction of up to 4.89 km^2 of artificial structures. The cumulative effect is predicted to be of local spatial extent, permanent, continuous and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Tier 2** The cumulative effects assessment for Tier 2 considers the following: • Mooir Vannin Offshore Windfarm • Morecambe Offshore Windfarm Generation Assets. 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 and scour protection (Mooir Vannin Offshore Windfarm Ltd, 2023). For the Morecambe Offshore Windfarm Generation Assets up to 0.46 km^2 of permanent habitat creation may be arise from scour protection, and cable protection (Morecambe Offshore Windfarm Ltd, 2023b). The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 and Tier 2 projects may result in the introduction of up to 5.35 km^2 of artificial structures.

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			The cumulative effect is predicted to be of local spatial extent, permanent, continuous and irreversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Tier 3** There are no Tier 3 projects active during the Morgan Generation Assets decommissioning phase.
Sensitivity of receptor	The sensitivity of the subtidal IEF are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.6.12 to 2.9.6.20. All of the subtidal IEFs (the subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF) are deemed to be of high vulnerability, low recoverability, and national value. The sensitivity of the IEFs is therefore, considered to be **high**.		
Significance of effect	Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative introduction of artificial structures impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be 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,	Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative introduction of artificial structures impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion has been reached	**Tier 1** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative introduction of artificial structures impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion has been reached because

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
	the large area over which this potential impact is dispersed.	because of the localised extent of the impact, the large area over which this potential impact is dispersed.	of the localised extent of the impact, the large area over which this potential impact is dispersed. **Tier 2** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative introduction of artificial structures impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be 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 are proposed.		

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

2.11.6.1 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 (Table 2.32). Cumulative increased risk of introduction or spread of INNS is predicted to occur as a result of the presence of the Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets, together with the Tier 1 projects (i.e. Mona Offshore Wind Project and Awel y Môr Offshore Windfarm) within the CEA benthic subtidal ecology study area.

2.11.6.2 Three Tier 2 projects have been identified within the CEA benthic subtidal ecology study area (Mooir Vannin Offshore Windfarm, Morecambe Offshore Windfarm Generation Assets and Eni Hynet CCS) as well as two Tier 3 projects, the MaresConnect interconnector cable and Isle of Man to UK Interconnector 2.

2.11.6.3 A full assessment of the impacts is presented in Table 2.32 below.

Table 2.32: Cumulative increased risk of introduction and spread of INNS.

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
Construction and operations and maintenance			
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Morgan Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. The installation of infrastructure for both of these projects would result in the introduction of up to 3.34 km^2 of artificial structures. This is the result of the installation of infrastructure described in the construction and operations and maintenance phases for the Morgan Generation Assets in section 2.9.7 together with 1.55 km^2 of artificial structures associated with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023). In addition to the vessel movements associated with the Morgan Generation Assets, there will be up to 740 vessel round trips during the construction phase and up to 1,155 vessel return trips during the 35 year operations and maintenance phase associated with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd., 2023).	The cumulative effects assessment for Scenario 2 considers the following: • The Morgan Generation Assets • Morecambe Offshore Windfarm Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. The installation of infrastructure for these three projects would result in the introduction of up to 3.80 km^2 of artificial structures. This is the result of the installation of infrastructure described in the construction and operations and maintenance phases for the Morgan Generation Assets in section 2.9.7 together with 1.55 km^2 of artificial structures introduced from the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023) and up to 0.46 km^2 of artificial structures associated with the Morecambe Offshore Windfarm Generation Assets (Morecambe Offshore Windfarm Ltd., 2023b). In addition to the vessel movements associated with the Morgan Generation Assets, there will be up to 740 vessel round trips during the construction phase and up to 1,155 vessel return trips during the 35 year operations and	The cumulative effects assessment for Scenario 3 considers Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1, Tier 2 and Tier 3 projects outlined below. **Tier 1** The cumulative effects assessment for Tier 1 considers the following: • Mona Offshore Wind Project • Awel y Môr Offshore Windfarm • Crogga oil and gas exploration licence. The construction of Awel y Môr Offshore Wind Farm is likely to introduce 1.07 km^2 of artificial infrastructure as well as up to 3,961 round trips, the operations 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 extent of hard substrate available for colonisation by INNS is also likely to decline throughout the operations and maintenance phase as some of the projects enter their decommissioning phases. The construction of the Mona Offshore Wind Project is likely to introduce 2.69 km^2 of artificial

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	maintenance phase of the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd Ltd., 2023). 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 operations and maintenance phase there may be up to 776 return vessel trips per year (Morecambe Offshore Windfarm Ltd., 2023b). The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	infrastructure as well as up to 2,215 round trips and the operations and maintenance phase is likely to result in 849 vessel round trips per year (Mona Offshore Wind Ltd, 2024). There limited information regarding the potential impacts associated with the Crogga oil and gas exploration licence, the project is however known to include exploratory drilling which may lead to the installation of artificial structures such as a well head and jack up which could be colonised by epifauna (Isle of Man Government, 2021). Additionally the geophysical and geotechnical surveys which have also been permitted under this licence will result in an increase in vessel traffic within the Morgan CEA benthic subtidal ecology study area (Isle of Man Government, 2021). The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 projects may result in the introduction of up to 7.10 km^2 of artificial structures. The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Tier 2** The cumulative effects assessment for Tier 2 considers the following:

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			• Mooir Vannin Offshore Windfarm • Morecambe Offshore Windfarm Generation Assets • Eni Hynet CCS. 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). For the Morecambe Offshore Windfarm Generation Assets, the predicted introduction of artificial hard structures during the operations and maintenance phase would equate to up to 0.46 km^2, 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 operations and maintenance phase there may be up to 776 return vessel trips per year (Morecambe Offshore Windfarm Ltd., 2023b). 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

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			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. The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 and Tier 2 projects may result in the introduction of up to 7.55 km^2 of artificial structures. The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Tier 3** The two Tier 3 projects which has been identified in the CEA with the potential to result in cumulative increased risk of introduction and spread of INNS with the Morgan Generation Assets are the MaresConnect interconnector cable and the Isle of Man to UK Interconnector 2. There is, however, currently no information on the impact that the MaresConnect interconnector and Isle of Man to UK Interconnector 2 cables will have on benthic ecology receptors.

	Scenario 1 **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects**
			A planning application is predicted to be submitted in 2024 which will identify and assess these impacts (MaresConnect, 2022). Cable protection associated with both interconnector cable 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) is likely to be similar to what is expected for the cables of the Morgan Generation Assets. The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent 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 the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.7.13 to 2.9.7.17 and above in Table 2.22. The subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF are deemed to be of high vulnerability, low recoverability, and national value. The sensitivity of the IEFs is therefore considered to be **high**.		
Significance of effect	Overall for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF, the magnitude	Overall for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF, the magnitude of the cumulative increased risk of	**Tier 1** Overall for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	of the cumulative increased risk of introduction and spread of INNS impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the likelihood that both projects will implement designed-in measures that will ensure that the risk of potential introduction and spread of INNS is minimised including the Morgan Generation Assets.	introduction and spread of INNS impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the likelihood that both projects will implement designed-in measures that will ensure that the risk of potential introduction and spread of INNS is minimised including the Morgan Generation Assets.	seapens and burrowing megafauna communities IEF, the magnitude of the cumulative increased risk of introduction and spread of INNS impact during the construction and operations and maintenance phases is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the likelihood that most offshore projects will implement designed-in measures that will ensure that the risk of potential introduction and spread of INNS is minimised including the Morgan Generation Assets. **Tier 2** Overall for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF, the magnitude of the cumulative increased risk of introduction and spread of INNS impact during the construction and operations and maintenance phases is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the likelihood that most offshore

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			projects will implement designed-in measures that will ensure that the risk of potential introduction and spread of INNS is minimised including the Morgan Generation Assets. **Tier 3** Overall for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF, the magnitude of the cumulative increased risk of introduction and spread of INNS impact during the construction and operations and maintenance phases is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the likelihood that most offshore projects will implement designed-in measures that will ensure that the risk of potential introduction and spread of INNS is minimised including the Morgan Generation Assets.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures are proposed.		

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
Decommissioning			
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • The Morgan Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. The installation of infrastructure for both of these projects would result in up to 2.76 km^2 of artificial structures. This is the result of the installation of infrastructure described in the decommissioning phase of section 2.9.7 as well as the cable protection and scour protection associated with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets resulting in 1.50 km^2 of artificial structures introduced (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023). Additionally there will be up to 740 vessel return trips decommissioning phase associated with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd., 2023).The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent 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 1 considers the following: • The Morgan Generation Assets • Morecambe Offshore Windfarm Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. In the decommissioning phase of the Morgan Generation Assets up to 3.21 km^2 of artificial structures could be left *in stu* from these projects resulting in permanent habitat creation. This is the result of the decommissioning of infrastructure described in section 2.9.7 as well as 1.50 km^2 of permanent habitat creation from the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023). Additionally there will be up to 740 vessel return trips decommissioning phase associated with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd., 2023). Furthermore up to 0.46 km^2 of artificial infrastructure will be installed with a similar number of vessel round trips expected during this is not represented in phase as during construction (Morecambe Offshore Windfarm Ltd., 2023b).	The cumulative effects assessment for Scenario 3 considers Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1, Tier 2 and Tier 3 projects outlined below. **Tier 1** The cumulative effects assessment for Tier 1 considers the following: • Mona Offshore Wind Project. The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 projects may result in the introduction of up to 4.89 km^2 of artificial structures. The Mona Offshore Wind Project which may leave up to 2.14 km^2 of artificial structures in situ following its decommissioning phase. Additionally vessel movement associated with the decommissioning of the Mona Offshore Wind Project is likely to result in up to 2,215 round trips, similar to what was produced for the construction phase (Mona Offshore Wind Ltd, 2024). The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
		The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.	**Tier 2** The cumulative effects assessment for Tier 2 considers the following: • Mooir Vannin Offshore Windfarm • Morecambe Offshore Windfarm Generation Assets. 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). For the Morecambe Offshore Windfarm Generation Assets, the predicted habitat creation during the decommissioning phase would equate to up to 0.46 km^2, with a similar number of vessel round trips expected during this phase as during construction (Morecambe Offshore Windfarm Ltd., 2023). The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 and Tier 2 projects may result in the introduction of up to 5.35 km^2 of artificial structures.

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			The cumulative effect is predicted to be of local spatial extent, medium term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**. **Tier 3** There are no Tier 3 projects active in this phase of the Morgan Generation Assets.
Sensitivity of receptor	The sensitivity of the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.7.13 to 2.9.7.17 and above in Table 2.22. The subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF are deemed to be of high vulnerability, low recoverability, and national value. The sensitivity of the IEFs is therefore considered to be **high**.		
Significance of effect	Overall for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF, the magnitude of the cumulative increased risk of introduction and spread of INNS impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion has been reached on	Overall for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF, the magnitude of the cumulative increased risk of introduction and spread of INNS impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the likelihood that both projects will implement designed-in measures	**Tier 1** Overall for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF, the magnitude of the cumulative increased risk of introduction and spread of INNS impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion has

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
	the basis of the likelihood that both projects will implement designed-in measures that will ensure that the risk of potential introduction and spread of INNS is minimised including the Morgan Generation Assets.	that will ensure that the risk of potential introduction and spread of INNS is minimised including the Morgan Generation Assets.	been reached on the basis of the likelihood that most offshore projects will implement designed-in measures that will ensure that the risk of potential introduction and spread of INNS is minimised including the Morgan Generation Assets. **Tier 2** Overall for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafauna communities IEF, the magnitude of the cumulative increased risk of introduction and spread of INNS impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the likelihood that most offshore projects will implement designed-in measures that will ensure that the risk of potential introduction and spread of INNS is minimised including the Morgan Generation Assets.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures are proposed.		

2.11.7 Removal of hard substrates

2.11.7.1 Cumulative removal of hard substrate may result from the removal of infrastructure such as foundations, cable protection and scour protection, wind turbines and OSPs. One Tier 1 offshore wind farm (Mona Offshore Wind Project) and one Tier 2 offshore wind farm (Morecambe Offshore Windfarm Generation Assets have been identified within the Morgan CEA benthic subtidal ecology study area. No relevant projects have been identified in Tier 3 (see Table 2.27).

2.11.7.2 A full assessment of the impacts is presented in Table 2.33 below.

Table 2.33: Cumulative removal of hard substrate.

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
Decommissioning			
Magnitude of impact	The cumulative effects assessment for Scenario 1 considers the following: • Morgan Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. The cumulative removal of hard substrate between these two projects may be up to 1.84 km^2. For the Morgan and Morecambe Offshore Wind Farms: Transmission Assets, the predicted maximum removal of hard substrate during the decommissioning phase would equate to up to 0.05 km^2 (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd., 2023). 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 cumulative effects assessment for Scenario 2 considers the following: • Morgan Generation Assets • Morecambe Offshore Windfarm Generation Assets • Morgan and Morecambe Offshore Wind Farms: Transmission Assets. The cumulative removal of hard substrate between these projects may be up to 2.29 km^2. For the Morgan and Morecambe Offshore Wind Farms: Transmission Assets, the predicted maximum removal of hard substrate during the decommissioning phase would equate to up to 0.05 km^2 (Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd., 2023). For the Morecambe Offshore Wind Farms Generation Assets, the predicted maximum removal of hard substrate during the decommissioning phase would equate to up to 0.45 km^2 (Morecambe Offshore Windfarm Ltd, 2023b). 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 cumulative effects assessment for Scenario 3 considers Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1, Tier 2 and Tier 3 projects outlined below. **Tier 1** The cumulative effects assessment for Tier 1 considers the following: • Mona Offshore Wind Project As with the Morgan Generation Assets the MDS for the Mona Offshore Wind Project assumes the removal of all hard substrate including wind turbine and OSP foundations, cable protection and scour protection resulting in up to 2.19 km^2 of hard substrate removal (Mona Offshore Wind Ltd, 2024). The Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 projects may result in up to 4.03 km^2 of hard substrate removal. 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.

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
			The magnitude is therefore, considered to be **low**. **Tier 2** The cumulative effects assessment for Tier 2 considers the following: • Morecambe Offshore Windfarm Generation Assets. For the Morecambe Offshore Wind Farms Generation Assets, the predicted maximum removal of hard substrate during the decommissioning phase would equate to up to 0.45 km^2 (Morecambe Offshore Windfarm Ltd, 2023b). The magnitude of the cumulative impacts for the Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets together with the Tier 1 and Tier 2 projects may result in up to 4.49 km^2 of long term habitat loss. 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 the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.6.25. The subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafuna communities IEF is deemed to be of high vulnerability, high recoverability, and national value. The sensitivity of the IEFs is therefore considered to be **low**.		

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	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
Significance of effect	Overall for the subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafuna communities IEF, the magnitude of the cumulative removal of hard substrate impact during the decommissioning phase 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. This conclusion is based on the ability of soft sediment habitats to recover following the removal of hard structures.	Overall for the subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafuna communities IEF, the magnitude of the cumulative removal of hard substrate impact during the decommissioning phase 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. This conclusion is based on the ability of soft sediment habitats to recover following the removal of hard structures.	**Tier 1** Overall for the subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafuna communities IEF, the magnitude of the cumulative removal of hard substrate impact during the decommissioning phase 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. This conclusion is based on the ability of soft sediment habitats to recover following the removal of hard structures and the likely small scale of the change in relation to the wider CEA benthic subtidal ecology study area. **Tier 2** Overall for the subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and seapens and burrowing megafuna communities IEF, the magnitude of the cumulative removal of hard substrate impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be low. The

	Scenario 1 **Morgan Generation Assets** **+ Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
			cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This conclusion is based on the ability of soft sediment habitats to recover following the removal of hard structures and the likely small scale of the change in relation to the wider CEA benthic subtidal ecology study area.
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures are proposed.		

2.11.8 Changes in physical processes

2.11.8.1 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 operations and maintenance phase of the Morgan Generation Assets. This potential impact is also relevant to the construction phase and following decommissioning associated with residual infrastructure.

2.11.8.2 A full assessment of the impacts is presented in (Table 2.33 below).

Table 2.34: Cumulative assessment of changes in physical processes.

	Scenario 1 **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects**
Construction			
Magnitude of impact	During the construction phase there will be gradual changes to tidal regime and wave climate as well as sediment transport and sediment transport pathways for Morgan Generation Assets and Transmission Assets with changes occurring from the baseline environment (no presence of infrastructure) to the operations and maintenance phase as assessed in the following operations and maintenance phase section. The cumulative effect on the subtidal habitat IEFs 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 indirectly. The magnitude is therefore, considered to be **low**. The cumulative effect on the West of Walney MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Copeland MCZ IEFs is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is	During the construction phase there will be gradual changes to tidal regime and wave climate as well as sediment transport and sediment transport pathways for Scenario 1 and Morecambe Generation Assets with changes occurring from the baseline environment (no presence of infrastructure) to the operations and maintenance phase as assessed in the following operations and maintenance phase section. The cumulative effect on the subtidal habitat IEFs 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 indirectly. The magnitude is therefore, considered to be **low**. The cumulative effect on the West of Walney MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Copeland MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**.	**Tier 1** The construction phase of Morgan Generation Assets and Transmission Assets coincides with the construction phase of Mona Offshore Wind Project. During this period there will be gradual changes to tidal regime and wave climate as well as sediment transport and sediment transport pathways from the baseline environment (no presence of infrastructure) to the combined operations and maintenance phases of all offshore wind projects, as assessed in the following operations and maintenance phase section. The construction phase of Morgan Generation Assets and Transmission Assets also overlaps 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 Morgan Generation Assets and 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 Generation Assets, a similar spatial impact and magnitude is expected. This change will take the form of a restoration of the natural tidal regime and wave climate as well as sediment transport regimes. The presence of

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.		the suction bucket foundations associated with the Morgan Generation Assets and Transmission Assets may alter tidal currents in the lee of the structure up to a distance of *c*. 500 m, beyond which point changes to the tidal regime are indiscernible from natural variability. Therefore the 3.1 km distance separating the projects, no cumulative effect is expected to arise. The change in wave climate associated with the removal of the Millom West offshore platform would be limited to c. 200 m from its original location. The presence of infrastructure associated with the Morgan Generation Assets and Transmission Assets may alter the wave climate in an overlapping area with the Millom West offshore platform when storm waves approach from the west/southwest, however given the scale of effect associated with the removal of the Millom West offshore platform alone, the cumulative change would be highly localised and of low order. The removal of the Millom West infrastructure will also result in the restoration of the natural sediment transport regime. Given the 3.1 km distance separating the projects, no cumulative effect is expected to arise with respect to sediment transport rates. The cumulative effect on the subtidal habitat IEFs 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 indirectly. The magnitude is therefore, considered to be **low**.

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			The cumulative effect on the West of Walney MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Copeland MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**. **Tier 2** The construction of the Morecambe Generation Assets was assessed under Scenario 2 and concluded there are no additional cumulative effects from Scenario 1 in relation to the West of Copeland MCZ and the West of Walney MCZ. The cumulative effect on the subtidal habitat IEFs 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 indirectly. The magnitude is therefore, considered to be **low**. The cumulative effect on the West of Walney MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**.

	Scenario 1 **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
			The cumulative effect on the West of Copeland MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**.
Sensitivity of receptor	The sensitivity of the subtidal habitat IEFs are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.9.34 to 2.9.9.38 and above in Table 2.24. The subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, brittlestar beds IEF and the Annex I low resemblance stony reef (outside an SAC) IEF are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **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 sensitivity of the West of Walney MCZ IEFs are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.9.41 and 2.9.9.42 and above in Table 2.24. The West of Walney MCZ subtidal mud IEF and subtidal sand IEF are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible**. The West of Walney MCZ 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 sensitivity of the West of Copeland MCZ IEFs are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.9.45 and 2.9.9.46 and above in Table 2.24. The West of Copeland MCZ subtidal coarse sediment IEF, subtidal mixed sediment IEF and subtidal sand IEF are deemed to not be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible**.		
Significance of effect	Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other	Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, brittlestar beds	**Tier 1** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	polychaetes IEF, brittlestar beds IEF and the Annex I low resemblance stony reef (outside an SAC) IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF and subtidal mud IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the	IEF and the Annex I low resemblance stony reef (outside an SAC) IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF and subtidal mud IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of	by *Lagis koreni* and other polychaetes IEF, brittlestar beds IEF and the Annex I low resemblance stony reef (outside an SAC) IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF and subtidal mud IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.	**negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.	considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. **Tier 2** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by Lagis koreni and other polychaetes IEF, brittlestar beds IEF and the Annex I low resemblance stony reef (outside an SAC) IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be low and the sensitivity of the

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be low and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF and subtidal mud IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the changes in

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the changes in physical processes impact during the construction phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.
Operations and maintenance			
Magnitude of impact	The Transmission Assets infrastructure which effects the tidal regime, wave climate and sediment transport and sediment transport pathways is comprised of OSPs and cable/scour protection. The influence of these structures is typically limited to 500 m for tidal impacts,1 km for wave impacts and 2 km for sediment transport impacts for Morecambe Generation Assets OSPs and cable protection in shallow water. This distance is significantly less at the Morgan Generations Assets offshore location. The Morgan Generation Assets and Transmission Assets are in close proximity to each other, therefore whilst there is some	The Morecambe Generation Assets infrastructure which effects the tidal regime, wave climate and sediment transport pathways is comprised of wind turbines and cable/scour protection. The impact on the tidal regime is predicted to be restricted to the immediate vicinity if the infrastructure, (i.e. immediately upstream and downstream of the structure in the form of a wake). The wake signature will dissipate and recover with distance downstream, becoming indistinguishable to ambient conditions within tens to a few hundreds of metres. The impact is on the wave climate predicted to occur principally in the immediate wake of the infrastructure, with alterations to the wave climate	**Tier 1** The operations and maintenance phase of Morgan Generation Assets and Transmission Assets coincides with the operations and maintenance phases of Mona Offshore Wind Project. The infrastructure proposed for the Mona Offshore Wind Project is of a similar type and scale to that of the Morgan Generation Assets and, as outlined for Morecambe Generation Assets under Scenario 1, the influence of these structures on the tidal regime is typically limited to 500 m and on the wave climate within 10 km. The influence on sediment transport is typically 2 km and no more than 10 km. Impacts will be

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	limited potential for cumulative impacts in the immediate vicinity of the infrastructure, this does not extend to the West of Copeland MCZ and the West of Walney MCZ designated receptors. The cumulative effect on the subtidal habitat IEFs 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 indirectly. The magnitude is therefore, considered to be **low**. The cumulative effect on the West of Walney MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Copeland MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**.	diminishing rapidly with increased distance and being indistinguishable from background levels at 10 km. Sediment transport may be influenced directly by infrastructure located on the seabed, which would be of a similar area of influence of tidal flow, or by changes to littoral currents, with a similar scale of influence as wave climate alterations. These impacts do not extend to the West of Copeland MCZ and the West of Walney MCZ designated receptors and there would therefore be no additional cumulative impacts from Scenario 1. The cumulative effect on the subtidal habitat IEFs 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 indirectly. The magnitude is therefore, considered to be **low**. The cumulative effect on the West of Walney MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Copeland MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**.	focused in the lee of the infrastructure in the form of a water wake. As outlined for Scenario 2, the sediment which enters the Morgan Array Area derives from the northern section of the corridor between Anglesey and the Isle of Man whilst the sediment which enters the Mona Array Area originates from the southern section of this corridor, also from an easterly direction, as it is located directly to the south of the Morgan Array Area, (ABPmer, 2023). As such, any potential changes to sediment budgets or sediment transport regimes as a result of the Morgan Generation Assets will not cumulatively impact with the Mona Offshore Wind Project as they do not share a common sediment transport pathway. So, whilst there is some limited potential for cumulative impacts in the immediate vicinity of the infrastructure with regards to Morecambe Generation Assets and Transmission Assets, this does not extend to the West of Copeland MCZ and the West of Walney MCZ designated receptors. The cumulative effect on the subtidal habitat IEFs is predicted to be of regional spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **low**. The cumulative effect on the West of Walney MCZ IEFs is predicted to be of local spatial

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Copeland MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**. **Tier 2** The operations and maintenance phase of Morgan Generation Assets and Transmission Assets coincides with the operations and maintenance phases of Morecambe Generation Assets and Mooir Vannin Offshore Wind Farm. The scoping report for Mooir Vannin Offshore Wind Farm indicates that, although the site generation is less than one tenth of that proposed for the Morgan Generation Assets, the maximum size of infrastructure is similar to that proposed for Morgan Transmission Assets, (Ørsted, 2023). Therefore, for typical infrastructure, the distance of influence of tidal regime is *circa* 500 m. The maximum size of infrastructure proposed for the Mooir Vannin Offshore Wind Farm there is a similar scale to that proposed for the Morgan Generation Assets, therefore the distance of influence of wave climate is *circa* 10 km (Ørsted, 2023). There is the

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			potential for the alteration in wave field from Morgan Generation Assets to extend to the Mooir Vannin Offshore Wind Farm and *vice versa*. However, it should be recognised that the changes in wave climate from each project arise from the same incident wave field and would not converge (i.e. waves approaching from the southwest would give rise to changes in wave fields to the northeast of both sites). For the maximum type and scale of infrastructure proposed within scoping report, (Ørsted, 2023), the distance of influence on sediment transport is anticipated to be *circa* 2 km. It is noted that Mooir Vannin Offshore Wind Farm is adjacent to the West of Copeland MCZ so it may be indirectly affected by presence of infrastructure however it would not be in the region potentially affected by Morgan Generation Assets and Transmission Assets. The cumulative effect on the subtidal habitat IEFs is predicted to be of regional spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **low**. The cumulative effect on the West of Walney MCZ IEFs is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Copeland MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**.
Sensitivity of receptor	The sensitivity of the subtidal habitat IEFs are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.9.34 to 2.9.9.38 and above in Table 2.24. The subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, brittlestar beds IEF and the Annex I low resemblance stony reef (outside an SAC) IEF are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **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 sensitivity of the West of Walney MCZ IEFs are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.9.41 and 2.9.9.42 and above in Table 2.24. The West of Walney MCZ subtidal mud IEF and subtidal sand IEF are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible**. The West of Walney MCZ 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 sensitivity of the West of Copeland MCZ IEFs are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.9.45 and 2.9.9.46 and above in Table 2.24. The West of Copeland MCZ subtidal coarse sediment IEF, subtidal mixed sediment IEF and subtidal sand IEF are deemed to not be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible**.		
Significance of effect	Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities	Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis*	**Tier 1 and Tier 2** Overall, for the subtidal coarse and mixed sediments with diverse benthic communities IEF, the subtidal sand and muddy sand

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	dominated by *Lagis koreni* and other polychaetes IEF, brittlestar beds IEF and the Annex I low resemblance stony reef (outside an SAC) IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the small magnitude and highly localised changes in physical processes predicted as a result of the Morgan Generation Assets and the high resistance of these IEFs to this potential impact. Overall, for the seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF and subtidal mud IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor	*koreni* and other polychaetes IEF, brittlestar beds IEF and the Annex I low resemblance stony reef (outside an SAC) IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the small magnitude and highly localised changes in physical processes predicted as a result of the Morgan Generation Assets and the high resistance of these IEFs to this potential impact. Overall, for the seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF and subtidal mud IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the small magnitude and highly localised changes in	sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, brittlestar beds IEF and the Annex I low resemblance stony reef (outside an SAC) IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the small magnitude and highly localised changes in physical processes predicted as a result of the Morgan Generation Assets and the high resistance of these IEFs to this potential impact. Overall, for the seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF and subtidal mud IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible to high. The effect will, therefore, be of **negligible**

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the small magnitude and highly localised changes in physical processes predicted as a result of the Morgan Generation Assets and the high resistance of these IEFs to this potential impact. Overall, for the West of Walney MCZ seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the small magnitude and highly localised changes in physical processes predicted as a result of the Morgan	physical processes predicted as a result of the Morgan Generation Assets and the high resistance of these IEFs to this potential impact. Overall, for the West of Walney MCZ seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal sand IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of negligible significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the small magnitude and highly localised changes in physical processes predicted as a result of the Morgan Generation Assets and the high resistance of these IEFs to this potential impact. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect	significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the small magnitude and highly localised changes in physical processes predicted as a result of the Morgan Generation Assets and the high resistance of these IEFs to this potential impact. Overall, for the West of Walney MCZ seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **minor** significance, which is not significant in EIA terms. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

	Scenario 1 **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets** **+ Tier 1, Tier 2, Tier 3 projects**
	Generation Assets and the high resistance of these IEFs to this potential impact. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the changes in physical processes impact during the operations and maintenance phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the small magnitude and highly localised changes in physical processes predicted as a result of the Morgan Generation Assets and the high resistance of these IEFs to this potential impact.	will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion has been reached on the basis of the small magnitude and highly localised changes in physical processes predicted as a result of the Morgan Generation Assets and the high resistance of these IEFs to this potential impact.	
Further mitigation and residual significance	No effects which are significant in EIA terms have been identified therefore no further mitigation measures are proposed.		
Decommissioning phase			
Magnitude of impact	Decommissioning of Morgan Generation Assets and Transmission Assets are on the same projected timeline. In both cases the only residual infrastructure is scour and cable protection and would have a negligible magnitude of impact on sediment transport and sediment transport pathways. Residual structures left on the seabed from decommissioning will not cause a cumulative	Decommissioning of Morgan Generation Assets, Morecambe Generation Assets and Transmission Assets are on the same projected timeline. In all cases the only residual infrastructure is scour and cable protection and would have a negligible magnitude of impact on sediment transport and sediment transport pathways. Residual structures left on the seabed from decommissioning will not cause a cumulative impact on changes to the	**Tier 1** Decommissioning of Morgan Generation Assets and Transmission Assets are on the same projected timeline as decommissioning of Mona Offshore Wind Project. In all cases the only residual infrastructure is scour and cable protection and would have a negligible magnitude of impact on tidal regime. Residual

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
	change to the tidal regime and will result in a lesser magnitude of impact than that described in the operations and maintenance phase. It is predicted that the impact will not affect West of Walney MCZ and the West of Copeland MCZ receptors. 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 not affect the receptors. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Walney MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Copeland MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**.	tidal regime and will result in a lesser magnitude of impact than that described in the operations and maintenance phase. It is predicted that the impact will not affect West of Walney MCZ and the West of Copeland MCZ receptors. 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 not affect the receptors. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Walney MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Copeland MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**.	structures left on the seabed from decommissioning will not cause a cumulative impact on changes to the tidal and wave regime and will result in a lesser magnitude of impact than that described in the operations and maintenance phase. It is predicted that the impact will not affect West of Walney MCZ and the West of Copeland MCZ receptors. 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 not affect the receptors. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Walney MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Copeland MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**. **Tier 2** Decommissioning of Morgan Generation Assets and Transmission Assets are on the same projected timeline as decommissioning of

	Scenario 1 Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Scenario 2: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets	Scenario 3: Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects
			Morecambe Generation Assets. The decommissioning of the Morecambe Generation Assets and Morecambe Offshore Windfarm Transmission Assets was assessed under Scenario 2 and concluded there are no additional cumulative effects from Scenario 1 in relation to the West of Copeland MCZ and the West of Walney MCZ. 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 not affect the receptors. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Walney MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**. The cumulative effect on the West of Copeland MCZ IEFs 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 indirectly. The magnitude is therefore, considered to be **negligible**.
Sensitivity of receptor	The sensitivity of the subtidal habitat IEFs are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.9.33 to 2.9.9.46 and above in Table 2.23. The subtidal coarse and mixed sediments with diverse benthic communities IEF, subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, brittlestar beds IEF and the Annex I low resemblance stony reef (outside an SAC) IEF are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible**.		

	Scenario 1 **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects**
	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 sensitivity of the West of Walney MCZ IEFs are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.9.41 and 2.9.9.42 and above in Table 2.24. The West of Walney MCZ subtidal mud IEF and subtidal sand IEF are deemed not to be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible**. The West of Walney MCZ 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 sensitivity of the West of Copeland MCZ IEFs are as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.9.45 and 2.9.9.46 and above in Table 2.24. The West of Copeland MCZ subtidal coarse sediment IEF, subtidal mixed sediment IEF and subtidal sand IEF are deemed to not be sensitive and are of national value. The sensitivity of the receptor is therefore considered to be **negligible**.		
Significance of effect	Overall, the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the subtidal habitat IEFs is considered to be low to medium. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF and subtidal mud IEF the magnitude of the changes in physical processes impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible to high. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.	Overall, the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the subtidal habitat IEFs is considered to be low to medium. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF and subtidal mud IEF the magnitude of the changes in physical processes impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible to high. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the decommissioning phase is deemed to be	**Tier 1 and Tier 2** Overall, the magnitude of the cumulative impact is deemed to be negligible and the sensitivity of the subtidal habitat IEFs is considered to be low to medium. The cumulative effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ subtidal sand IEF and subtidal mud IEF the magnitude of the changes in physical processes impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible to high. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. Overall, for the West of Walney MCZ seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact

	Scenario 1 **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets**	**Scenario 2:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Morecambe Offshore Windfarm Generation Assets**	**Scenario 3:** **Morgan Generation Assets + Morgan and Morecambe Offshore Wind Farms: Transmission Assets + Tier 1, Tier 2, Tier 3 projects**
	Overall, for the West of Walney MCZ seapens and burrowing megafauna IEF the magnitude of the changes in physical processes impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion is based on the very small scale of this impact in the decommissioning phase. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the changes in physical processes impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.	negligible and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion is based on the very small scale of this impact in the decommissioning phase. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the changes in physical processes impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.	during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be high (reducing to medium in the absence of seapens). The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms. This conclusion is based on the very small scale of this impact in the decommissioning phase. Overall, for the West of Copeland MCZ subtidal coarse sediment IEF, subtidal mixed sediment IEF and the subtidal sand IEF the magnitude of the changes in physical processes impact during the decommissioning phase is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible** 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.		

2.11.9 Future monitoring

2.12 Overall, no cumulative effects which are significant in EIA terms have been identified therefore, in terms of benthic subtidal ecology, no specific monitoring is required.

2.13 Monitoring related to undertaking maintenance activities is outlined in the project description, Volume 1, Chapter 3: Project description of the Environmental Statement. This includes routine inspections of inter-array and interconnector cables to ensure the cables are buried to an adequate depth and not exposed. It is anticipated that geophysical surveys will be required as a condition of the marine licence.

2.14 In addition, as outlined in the Offshore in-principle monitoring plan (Document Reference J11), DDV asset integrity surveys of the foundations will likely be undertaken at least every four years during the operations and maintenance phase using a remotely operated vehicle. Any footage available from these surveys will be reviewed by suitably experienced marine ecologists to determine whether the quality would allow for the identification of INNS. If so, the footage would be reviewed by suitably experienced marine ecologists in accordance with the requirements of the INNS Management Plan which will be included in the Offshore EMP (see Table 2.17).

2.15 Transboundary effects

2.15.1.1 A screening of transboundary impacts has been carried out and any potential for significant transboundary effects with regard to benthic subtidal ecology from the Morgan Generation Assets upon the interests of other states has been assessed as part of this Environmental Statement. The potential transboundary impacts assessed within Volume 3, Annex 5.2: Transboundary impacts screening of the Environmental Statement are summarised below.

2.15.1.2 As set out above, the majority of impacts on subtidal habitat IEF receptors will be restricted to the within the Morgan Array Area. Exceptions to this are impacts from increased SSC and associated sediment deposition and changes in physical processes, which have the potential to extend into Isle of Man waters.

2.15.1.3 The impact of increased SSCs and associated sediment deposition has a magnitude deemed to be low, and the sensitivity of the receptors is considered to be low to medium, with the significance therefore being negligible to minor adverse. However, the identified tidal excursion of 20 km means that any increased SSC is likely to settle out before crossing any international boundaries, suggesting this potential impact is unlikely to have any significant transboundary effect.

2.15.1.4 Changes in physical processes have a magnitude deemed to be low, and the sensitivity of the receptors is considered to be negligible to high, with the significance therefore being negligible to minor adverse. The impacts of infrastructure on the wave / tidal regime and sediment transport pathways are unlikely to extend beyond 500 m from the infrastructure therefore unlikely to cross over in to Isle of Man territorial waters, suggesting this potential impact is unlikely to have any significant transboundary effect.

2.15.1.5 Based on the above assessment, no significant transboundary effects on benthic subtidal habitat IEFs are predicted as a result of the Morgan Generation Assets.

2.16 Inter-related effects

2.16.1.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of the proposal on the same receptor. These are considered to be:

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the Morgan Generation Assets (construction, operations and maintenance and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three phases (e.g. subsea noise effects from piling, operational wind turbines, vessels and decommissioning)
- Receptor led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on benthic subtidal ecology, such as direct habitat loss or disturbance, increased SSC, may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects may be short term, temporary or transient effects, or incorporate longer term effects.

2.16.1.2 A description of the likely interactive effects arising from the Morgan Generation Assets on benthic subtidal ecology is provided in Volume 2, Chapter 15: Inter-related effects – Offshore of the Environmental Statement.

Table 2.35: Summary of likely significant inter-related effects on the environment for individual effects occurring across the construction, operations and maintenance, and decommissioning phases of the Morgan Generation Assets and from multiple effects interacting across all phases (receptor-led effects).

Description of impact	Phase[a]			Likely significant inter-related effects	Significance
	C	O	D		
Temporary and long term habitat loss/disturbance	✓	✓	✓	The total area of habitat potentially affected, when disturbance and loss are considered additively across all phases, is greater than for each individual phase (e.g. just the construction phase). However, temporary habitat loss/disturbance arising during each phase of the Morgan Generation Assets will be highly localised to the vicinity of the activities being undertaken (i.e. limited to the immediate footprints) during each phase (i.e. construction, operations and maintenance, and decommissioning). Individual activities (e.g. jack-up activities, cable burial etc.). Temporary habitat loss/disturbance will occur intermittently throughout this time with only a small proportion of the total area of habitat being impacted at any one time. The predominantly mixed sediment habitats present within the Morgan Array Area are typical of, and widespread throughout, the UK and in the east Irish Sea. All sediments and associated benthic communities are predicted to recover. Whilst there is the potential for repeat disturbance to occur during the operations and maintenance phase to habitats previously disturbed during the construction phase (e.g. as a result of jack-up activities and cable repair/reburial etc.) it is predicted that the benthic communities will have fully recovered from construction impacts by this time. Across the project lifetime, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase or when considered in conjunction with other topics addressed in the Environmental Statement.	No change resulting from inter-related assessment.
Increased SSCs and associated sediment deposition	✓	✓	✓	Activities with the potential to result in the greatest level seabed disturbance and, therefore, highest increases in SSC/deposition, will occur during the construction phase. Any effects on benthic communities during this time will be intermittent, temporary and short term. The benthic subtidal IEFs potentially affected by increased SSC and deposition are predicted to have recovered in the intervening period between phases (i.e. prior to any localised increases in SSC during maintenance activities in the operations and maintenance phase). Across the project lifetime, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented	No change resulting from inter-related assessment.

Description of impact	Phase[a]			Likely significant inter-related effects	Significance
	C	O	D		
				for each individual phase or when considered in conjunction with other topics addressed in the Environmental Statement.	
Disturbance/remobilisation of sediment-bound contaminants	✓	✓	✓	This impact is expected to occur in the construction, operations and maintenance, and decommissioning phases of the Morgan Generation Assets during activities that disturb seabed sediments. However, additive effects across the lifetime of the Morgan Generation Assets are considered highly unlikely on the basis of the physical processes modelling outputs which have shown that increases in SSC (and therefore associated contaminants) will be temporary and will return to baseline within a few tidal cycles, as well as the low levels of contamination which were detected in the site-specific surveys. This is not predicted to result in any significant combined impact across phases greater than what has been assessed for each individual phase. For example, remobilisation as a result of construction activities will only result in low concentrations of sediment bound contaminants which as noted above will have been dispersed over a large area therefore, they will not interact with potential contaminants released from operations and maintenance activities. Across the project lifetime, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase or when considered in conjunction with other topics addressed in the Environmental Statement.	No change resulting from inter-related assessment.
Introduction of artificial structures	✓	✓	✓	This impact will occur throughout the construction and operations and maintenance phases of the Morgan Generation Assets. The communities that develop on the introduced artificial structures will likely differ from the surrounding sedimentary biotopes but may be typical of areas of coarse and stony substrate in the area and is likely to result in an increase in biodiversity. Also, the amount of the hard infrastructure is expected to be consistent between the construction and operations and maintenance phases, and this will provide long-term stability to any communities which form. Across the project lifetime, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase or when considered in conjunction with other topics addressed in the Environmental Statement.	No change resulting from inter-related assessment.
Increased risk of introduction and spread of invasive and non-native species	✓	✓	✓	Although the presence and movement of construction/decommissioning vessels in the area may facilitate the introduction and spread of INNS	No change resulting from inter-related assessment

Description of impact	Phase[a]			Likely significant inter-related effects	Significance
	C	O	D		
				across all phases of the Morgan Generation Assets, this effect will predominantly arise during the operations and maintenance phase, if it does occur. This is because, the presence of the hard substrate associated with the infrastructure will be present in the operations and maintenance phase which may provide INNS with the necessary substrate on which to settle. However, the measures adopted as part of the Morgan Generation Assets include the implementation of the Offshore Environmental Management Plan with provisions for management of INNS. This will ensure that the risk of potential introduction and spread of INNS will be minimised across all phases. As a result, any additional inter-related effect is judged to be of minor significance in all phases of the Morgan Generation Assets (i.e. of no greater significance than those assessed for each individual phase). Across the project lifetime, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase or when considered in conjunction with other topics addressed in the Environmental Statement.	
Removal of hard substrate	×	×	✓	This effect will only arise during the decommissioning phase. Across the project lifetime, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase or when considered in conjunction with other topics addressed in the Environmental Statement.	No change resulting from inter-related assessment.
Alteration of seabed habitats arising from effects of physical processes	×	✓	✓	Across the project lifetime, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase or when considered in conjunction with other topics addressed in the Environmental Statement.	No change resulting from inter-related assessment.
EMF from subsea electrical cabling	×	✓	×	This effect will only arise during the operations and maintenance phase. Across the project lifetime, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase or when considered in conjunction with other topics addressed in the Environmental Statement.	No change resulting from inter-related assessment.
Heat from subsea electrical cabling.	×	✓	×	This effect will only arise during the operations and maintenance phase. Across the project lifetime, the effects on benthic ecology receptors are not	No change resulting from inter-related assessment.

Description of impact	Phase[a]			Likely significant inter-related effects	Significance
	C	O	D		
				anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase or when considered in conjunction with other topics addressed in the Environmental Statement.	

Receptor-led effects

There is the potential for spatial and temporal interactions between the effects arising from habitat loss/disturbance/alteration and increased SSC and associated sediment deposition and resuspension of contaminants, EMF and heat on benthic habitats during the lifetime of the Morgan Generation Assets.

Based on current understanding, and expert knowledge, the greatest potential for inter-related impacts is predicted to arise through the interaction of direct (both temporary and permanent) habitat loss/disturbance from seabed preparation, foundation installation/jack-up/anchor placement/scour, indirect habitat disturbance due to sediment deposition and indirect effects of changes in physical processes due to the Morgan Generation Assets.

These individual impacts were assigned a significance of negligible to minor as individual impacts and although potential combined impacts may arise (i.e. spatial and temporal overlap of habitat disturbance), it is not predicted that this will result in effects of more significance than the individual impacts in isolation. This is because the combined extent of habitat potentially affected would be typically restricted to the Morgan Generation Assets and wider ZoI, the habitats affected are widespread across the UK and east Irish Sea and, where temporary disturbance occurs, full recovery of the benthos is predicted. In addition, any effects due to changes in the physical processes are likely to be limited, both in extent (i.e. largely within the Morgan Array Area) and also in magnitude, with benthic ecology receptors having low sensitivity or high recoverability to the scale of the changes predicted.

Across the project lifetime, the additive effects on benthic ecology receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase or when considered in conjunction with other topics addressed in the Environmental Statement.

2.17 Summary of impacts, mitigation measures and monitoring

2.17.1.1 Information on benthic subtidal ecology within the benthic subtidal ecology study area was collected through desktop and site-specific surveys. The habitats within the Morgan Array Area were found to be widespread and an assessment has been undertaken to understand the impact of the Morgan Generation Assets on these habitats. The impact pathways assessed and the assessment itself was informed by stakeholder engagement.

- Table 2.36 presents a summary of the potential direct and indirect impacts, measures adopted as part of the Morgan Generation Assets and residual effects in respect to benthic subtidal ecology. The impacts assessed include: temporary habitat loss/disturbance, increased SSC and associated deposition, disturbance/remobilisation of sediment-bound contaminants, long term habitat loss/habitat alteration, introduction of artificial structures, increased risk of introduction and spread of INNS, removal of hard substrates, changes in physical processes, EMF from subsea electrical cabling and heat from subsea electrical cables. **For all of the impacts, phases and IEFs it is concluded that there will be no significant effects arising from the Morgan Generation Assets during the construction, operations and maintenance or decommissioning phases**
- Table 2.37 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/habitat alteration, introduction of artificial structures, increased risk of introduction and spread of INNS, removal of hard substrate and changes in physical processes. **For all of the cumulative impacts, phases and IEFs it is concluded that there will be no significant effects arising from the Morgan Generation Assets alongside other projects/plans.**
- **No significant transboundary impacts have been identified in regard to effects of the Morgan Generation Assets.**

Table 2.36: Summary of potential environmental effects, mitigation and monitoring.

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

Description of impact	Phase[a]			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
Temporary habitat loss/disturbance	✓	✓	✓	Development and adherence to, an Offshore CMS, including a CSIP which will include cable burial where possible and cable protection. Development of and adherence to an CMS, which will include details of scour protection management, to be used around offshore structures and foundations to reduce scour as much as is practical.	Subtidal habitat IEFs C: Low O: Negligible D: Low	Subtidal habitat IEFs • Medium to High	Subtidal habitat IEFs C: Minor adverse O: Minor adverse D: Minor adverse	N/A	C: Minor adverse O: Minor adverse D: Minor adverse	None
Increased SSC and associated deposition	✓	✓	✓	Development and adherence to an Offshore CMS which includes a CSIP which requires that material arising from drilling and/or sandwave clearance will be deposited in close proximity to the works and within the licenced disposal area applied for	Subtidal habitat IEFs C: Low O: Negligible D: Negligible West of Walney MCZ IEFs C: Negligible O: Negligible D: Negligible	Subtidal habitat IEFs • Negligible to High West of Walney MCZ IEFs • Negligible to High West of Copeland MCZ IEFs	Subtidal habitat IEFs C: Negligible to Minor adverse O: Negligible D: Negligible West of Walney MCZ IEFs C: Negligible O: Negligible D: Negligible	N/A	C: Negligible to Minor adverse O: Negligible D: Negligible	None

Description of impact	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
				(which is the Morgan Array Area).	West of Copeland MCZ IEFs C: Negligible O: Negligible D: Negligible	• Negligible to Low	West of Copeland MCZ IEFs C: Negligible O: Negligible D: Negligible			
Disturbance/remobilisation of sediment-bound contaminants	✓	×	✓	None	Subtidal habitat IEFs C: Negligible D: Negligible West of Walney MCZ IEFs C: Negligible D: Negligible West of Copeland MCZ IEFs C: Negligible D: Negligible	Subtidal habitat IEFs • Low West of Walney IEFs • Low West of Copeland IEFs • Low	Subtidal habitat IEFs C: Negligible D: Negligible West of Walney MCZ IEFs C: Negligible D: Negligible West of Copeland MCZ IEFs C: Negligible D: Negligible	N/A	C: Negligible D: Negligible	None
Long term habitat loss	✓	✓	✓	None	Subtidal habitat IEFs C and O: Low D: Low	Subtidal habitat IEFs • High	Subtidal habitat IEFs C and O: Minor adverse D: Minor adverse	N/A	C and O: Minor adverse D: Minor adverse	None
Colonisation of hard structures	✓	✓	×	None	Subtidal habitat IEFs C and O: Low D: Low	Subtidal habitat IEFs • High	Subtidal habitat IEFs C and O: Minor adverse	N/A	C and O: Minor adverse D: Minor adverse	None

Description of impact	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
							D: Minor adverse			
Increased risk of introduction and spread of invasive non-native species (INNS).	✓	✓	✓	Development of, and adherence to, an Offshore EMP. This will include Biosecurity Risk Assessment and an INNS Management Plan, including actions to minimise INNS.	Subtidal habitat IEFs C: Low O: Low D: Low	Subtidal habitat IEFs • High	Subtidal habitat IEFs C: Minor adverse O: Minor adverse D: Minor adverse	N/A	C: Minor adverse O: Minor adverse D: Minor adverse	No benthic subtidal ecology monitoring to test the predictions made within the impact assessment is considered necessary. However, as outlined in the Offshore in-principle monitoring plan (Document Reference J11), DDV surveys of the foundations will likely be undertaken at least every four years during the operation and maintenance phase using a remotely operated vehicle. Any footage available from these surveys will be reviewed by suitably experienced marine ecologists to determine whether the quality would allow for the identification of INNS. If so, the footage would be reviewed by suitably experienced marine ecologists in accordance with the requirements of the INNS Management Plan which will be

Description of impact	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
										included in the Offshore EMP (see Table 2.17).
Removal of hard substrates.	×	×	✓	None	Subtidal habitat IEFs D: Low	Subtidal habitat IEFs • Low	Subtidal habitat IEFs D: Minor adverse	N/A	D: Minor adverse	None
Changes in physical processes.	×	✓	✓	No more than 5% reduction in water depth (referenced to Chart Datum) will occur without prior written approval from the Licensing Authority in consultation with the MCA.	Subtidal habitat IEFs O: Low D: Negligible West of Walney MCZ IEFs O: Negligible D: Negligible West of Copeland MCZ IEFs O: Negligible D: Negligible	Subtidal habitat IEFs • Negligible to High West of Walney MCZ IEFs • Negligible to High West of Copeland MCZ IEFs • Negligible	Subtidal habitat IEFs O: Negligible to Minor adverse D: Negligible West of Walney MCZ IEFs O: Negligible D: Negligible West of Copeland MCZ IEFs O: Negligible D: Negligible	N/A	O: Negligible to Minor adverse D: Negligible	None
Electromagnetic Fields (EMF) from subsea electrical cabling	×	✓	×	Development and adherence to, a CMS, including a CSIP which will include cable burial where possible and cable protection. Development of and adherence to an offshore CMS, which will include details of	Subtidal habitat IEFs O: Negligible	Subtidal habitat IEFs • Low	Subtidal habitat IEFs O: Negligible	N/A	O: Negligible	None

Description of impact	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
				scour protection management, to be used around offshore structures and foundations to reduce scour as much as is practical.						
Heat from subsea electrical cables	×	✓	×	Development and adherence to, an Offshore CMS, including a CSIP which will include cable burial where possible and cable protection. Development of and adherence to an CMS, which will include details of scour protection management, to be used around offshore structures and foundations to reduce scour as much as is practical.	Subtidal habitat IEFs O: Negligible	Subtidal habitat IEFs • Low to Medium	Subtidal habitat IEFs O: Negligible	N/A	O: Negligible	None

Table 2.37: Summary of potential cumulative environmental effects, mitigation and monitoring.

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

Description of effect	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
Tier 1										
Temporary habitat loss/disturbance	✓	✓	✓	Development and adherence to, an Offshore CMS, including a CSIP which will include cable burial where possible and cable protection. Development of and adherence to an CMS, which will include details of scour protection management, to be used around offshore structures and foundations to reduce scour as much as is practical.	Subtidal habitat IEFs C: Medium O: Low D: Low	Subtidal habitat IEFs • Medium to High.	Subtidal habitat IEFs C: Minor adverse O: Minor adverse D: Minor adverse	N/A	C: Minor adverse O: Minor adverse D: Minor adverse	None
Increased SSC and associated deposition	✓	✓	✓	Development and adherence to an Offshore CMS which includes a CSIP which requires that material arising from drilling and/or sandwave clearance will be deposited in close proximity to the works and within the licenced disposal area applied for (which is the Morgan Array Area).	Subtidal Habitat IEFs C: Low O: Negligible D: Negligible West of Walney C: Negligible O: Negligible D: Negligible West of Copeland C: Negligible O: Negligible D: Negligible	Subtidal habitat IEFs • Low to Medium West of Walney IEFs • Negligible West of Copeland IEFs • Negligible to Low	Subtidal Habitat IEFs C: Negligible to Minor adverse O: Negligible D: Negligible West of Walney C: Negligible O: Negligible D: Negligible West of Copeland C: Negligible O: Negligible D: Negligible	N/A	C: Negligible to Minor adverse O: Negligible D: Negligible	None

Description of effect	Phase[a]			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
Long term habitat loss.	✓	✓	✓	None	Subtidal habitat IEFs C and O: Low D: Low	Subtidal habitat IEFs • High	Subtidal habitat IEFs C and O: Minor adverse D: Minor adverse	N/A	C and O: Minor adverse D: Minor adverse	None
Colonisation of hard structures.	✓	✓	×	None	Subtidal habitat IEFs C and O: Low D: Low	Subtidal habitat IEFs • High	Subtidal habitat IEFs C and O: Minor adverse D: Minor adverse	N/A	C and O: Minor adverse D: Minor adverse	None
Increased risk of introduction and spread of INNS.	✓	✓	✓	Development of, and adherence to, an Offshore EMP. This will include Biosecurity Risk Assessment and an INNS Management Plan, including actions to minimise INNS.	Subtidal habitat IEFs C: Low O: Low D: Low	Subtidal habitat IEFs • High	Subtidal habitat IEFs C: Minor adverse O: Minor adverse D: Minor adverse	N/A	C: Minor adverse O: Minor adverse D: Minor adverse	None
Removal of hard substrates.	×	×	✓	None	Subtidal habitat IEFs D: Low	Subtidal habitat IEFs • Low	Subtidal habitat IEFs D: Minor adverse	N/A	D: Minor adverse	None

Description of effect	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
Changes in physical processes.	✓	✓	✓	No more than 5% reduction in water depth (referenced to Chart Datum) will occur without prior written approval from the Licensing Authority in consultation with the MCA.	Subtidal Habitat IEFs C: Low O: Low D: Negligible West of Walney MCZ IEFs C: Negligible O: Negligible D: Negligible West of Copeland MCZ IEFs C: Negligible O: Negligible D: Negligible	Subtidal habitat IEFs • Negligible to High West of Walney MCZ IEFs • Negligible to High West of Copeland MCZ IEFs • Negligible	Subtidal Habitat IEFs C: Negligible to Minor adverse O: Negligible to Minor adverse D: Negligible to Minor adverse West of Walney MCZ IEFs C: Negligible O: Negligible D: Negligible West of Copeland MCZ IEFs C: Negligible O: Negligible D: Negligible	N/A	C: Negligible to Minor adverse O: Negligible to Minor adverse D: Negligible to Minor adverse	None
Tier 2										
Temporary habitat loss/disturbance	✓	✓	✓	Development and adherence to, an Offshore CMS, including a CSIP which will include cable burial where possible and cable protection. Development of and adherence to an CMS, which will include details of scour protection management, to be used around offshore structures and foundations to reduce scour as much as is practical.	Subtidal Habitat IEFs C: Low - Medium O: Low D: Low	Subtidal habitat IEFs • Medium to High	Subtidal habitat IEFs C: Minor adverse O: Minor adverse D: Minor adverse	N/A	C: Minor adverse O: Minor adverse D: Minor adverse	None

Description of effect	Phase[a]			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
Increased SSC and associated deposition	✓	✓	✓	Development and adherence to an Offshore CMS which includes a CSIP which requires that material arising from drilling and/or sandwave clearance will be deposited in close proximity to the works and within the licenced disposal area applied for (which is the Morgan Array Area).	Subtidal Habitat IEFs C: Low O: Negligible D: Negligible West of Walney MCZ IEFs C: Negligible O: Negligible D: Negligible West of Copeland MCZ IEFs C: Negligible O: Negligible D: Negligible	Subtidal habitat IEFs • Low to Medium West of Walney MCZ IEFs • Negligible West of Copeland MCZ IEFs • Negligible to Low	Subtidal Habitat IEFs C: Negligible to Minor adverse O: Negligible D: Negligible West of Walney MCZ IEFs C: Negligible O: Negligible D: Negligible West of Copeland MCZ IEFs C: Negligible O: Negligible D: Negligible	N/A	C: Negligible to Minor adverse O: Negligible D: Negligible	None
Long term habitat loss.	✓	✓	✓	None	Subtidal habitat IEFs C and O: Low D: Low	Subtidal habitat IEFs • High	Subtidal habitat IEFs C and O: Minor adverse D: Minor adverse	N/A	C and O: Minor adverse D: Minor adverse	None
Colonisation of hard structures.	✓	✓	×	None	Subtidal habitat IEFs C and O: Low D: Low	Subtidal habitat IEFs • High	Subtidal habitat IEFs C and O: Minor adverse D: Minor adverse	N/A	C and O: Minor adverse D: Minor adverse	None

Description of effect	Phase^a			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
	C	O	D							
Increased risk of introduction and spread of INNS.	✓	✓	✓	Development of, and adherence to, an Offshore EMP. This will include Biosecurity Risk Assessment and an INNS Management Plan, including actions to minimise INNS.	Subtidal habitat IEFs C: Low O: Low D: Low	Subtidal habitat IEFs • High	Subtidal habitat IEFs C: Minor adverse O: Minor adverse D: Minor adverse	N/A	C: Minor adverse O: Minor adverse D: Minor adverse	None
Removal of hard substrates.	×	×	✓	None	Subtidal habitat IEFs D: Low	Subtidal habitat IEFs • Low	Subtidal habitat IEFs D: Minor adverse	N/A	D: Minor adverse	None
Changes in physical processes.	✓	✓	✓	No more than 5% reduction in water depth (referenced to Chart Datum) will occur without prior written approval from the Licensing Authority in consultation with the MCA.	Subtidal Habitat IEFs C: Low O: Negligible D: Negligible West of Walney MCZ IEFs C: Negligible O: Negligible D: Negligible West of Copeland MCZ IEFs C: Negligible O: Negligible	Subtidal habitat IEFs • Negligible to High West of Walney MCZ IEFs • Negligible to High West of Copeland MCZ IEFs • Negligible	Subtidal Habitat IEFs C: Negligible to Minor adverse O: Negligible to Minor adverse D: Negligible West of Walney MCZ IEF C: Negligible O: Negligible D: Negligible West of Copeland MCZ IEF C: Negligible O: Negligible	N/A	C: Negligible to Minor adverse O: Negligible to Minor adverse D: Negligible	None

Description of effect	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
					D: Negligible		D: Negligible			
Tier 3										
Temporary habitat loss/disturbance	✓	✓	✓	Development and adherence to, an Offshore CMS, including a CSIP which will include cable burial where possible and cable protection. Development of and adherence to an CMS, which will include details of scour protection management, to be used around offshore structures and foundations to reduce scour as much as is practical.	Subtidal habitat IEFs C: Medium O: Low	Subtidal habitat IEFs • Medium to High	Subtidal habitat IEFs C: Minor adverse O: Minor adverse	N/A	C: Minor adverse O: Minor adverse	None
Increased SSC and associated deposition	✓	×	×	Development and adherence to an Offshore CMS which includes a CSIP which requires that material arising from drilling and/or sandwave clearance will be deposited in close proximity to the works and within the licenced disposal area applied for (which is the Morgan Array Area).	Subtidal Habitat IEFs C: Low West of Walney MCZ IEFs C: Negligible West of Copeland MCZ IEFs C: Negligible	Subtidal habitat IEFs • Low to Medium West of Walney MCZ IEFs • Negligible West of Copeland MCZ IEFs Negligible to Low	Subtidal Habitat IEFs C: Negligible to Minor adverse West of Walney MCZ IEFs C: Negligible West of Copeland MCZ IEFs C: Negligible	N/A	C: Negligible to Minor adverse	None
Long term habitat loss.	✓	✓	×	Development and adherence to an Offshore CMS which includes a CSIP which requires that material arising from drilling and/or sandwave clearance will be	Subtidal habitat IEFs C and O: Low	Subtidal habitat IEFs • High	Subtidal habitat IEFs C and O: Minor adverse	N/A	C and O: Minor adverse	None

Description of effect	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual significant effect	Proposed monitoring
				deposited in close proximity to the works and within the licenced disposal area applied for (which is the Morgan Array Area).						
Colonisation of hard structures.	✓	✓	×	None	Subtidal habitat IEFs C and O: Low	Subtidal habitat IEFs • High	Subtidal habitat IEFs C and O: Minor adverse	N/A	C and O: Minor adverse	None
Increased risk of introduction and spread of INNS.	✓	✓	×	Development of, and adherence to, an Offshore EMP. This will include Biosecurity Risk Assessment and an INNS Management Plan, including actions to minimise INNS.	Subtidal habitat IEFs C: Low O: Low	Subtidal habitat IEFs • High	Subtidal habitat IEFs C: Minor adverse O: Minor adverse	N/A	C: Minor adverse O: Minor adverse	None

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A.1 Cumulative Effects Assessment Appendix

A.1.1 Temporary habitat disturbance/loss

Scenario 1: Morgan Generation Assets together with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets

Construction phase

Magnitude of impact

A.1.1.1.1 The predicted cumulative temporary habitat loss/disturbance from the Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets during the construction phase would equate to 125.45 km^2. This includes all of the subtidal temporary habitat loss/disturbance described in Table 2.16 associated with the construction of the Morgan Generation Assts together with up to 64.03 km^2 of temporary habitat disturbance/loss associated with the construction of the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (i.e. installation of OSPs and interconnector and export cables) (Morgan Offshore Wind Project Ltd. and Morecambe Offshore Windfarms Ltd., 2023).

A.1.1.1.2 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**.

Sensitivity of receptor

A.1.1.1.3 The sensitivity of the IEFs to temporary habitat loss/disturbance is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and in Table 2.19.

A.1.1.1.4 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

A.1.1.1.5 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).

Significance of effect

A.1.1.1.6 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the construction phase 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 2.6.2 and the matrix in Table 2.15, 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 2.9.2.12 to 2.9.2.20, 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.

Operations and maintenance phase

Magnitude of impact

A.1.1.1.7 The predicted cumulative temporary habitat loss/disturbance from the Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets during the operations and maintenance phase would equate to up to 21.62 km^2. This includes all of the temporary habitat disturbance described in Table 2.16 associated with the operations and maintenance of the Morgan Generation Assets together with up to 10.26 km^2 of temporary habitat disturbance/loss associated with the operations and maintenance of the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (i.e. jack up events and repair and replacement for the interconnector and export cables; Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd, 2023). This cumulative impact from the two projects will occur intermittently across the 35 year operational lifetime of the Transmission Assets.

A.1.1.1.8 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**.

Sensitivity of the receptor

A.1.1.1.9 The sensitivity of the IEFs to temporary habitat loss/disturbance is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and in Table 2.19.

A.1.1.1.10 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

A.1.1.1.11 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).

Significance of effect

A.1.1.1.12 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the operation and maintenance phase 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 significant in EIA terms. This conclusion has been reached based on the small area impacted in this phase and limited area of disturbance.

Decommissioning phase

Magnitude of impact

A.1.1.1.13 The predicted cumulative temporary habitat loss/disturbance from the Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets during the decommissioning phase may result in similar levels of disturbance as in the construction phase (paragraph A.1.1.1.1). 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 Generation Assets.

A.1.1.1.14 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**.

Sensitivity of the receptor

A.1.1.1.15 The sensitivity of the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and in Table 2.19.

A.1.1.1.16 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

A.1.1.1.17 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).

Significance of effect

A.1.1.1.18 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the decommissioning phase 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 significant in EIA terms. This conclusion has been reached based on the small area impacted in this phase and limited area of substratum removal.

Scenario 2: Morgan Generation Assets together with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm Generation Assets

Construction phase

Magnitude of impact

A.1.1.1.19 The predicted cumulative temporary habitat loss/disturbance from the Morgan Generation Assets together with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm Generation Assets during the construction phase would equate to 128.91 km^2. This includes all of the subtidal temporary habitat loss/disturbance described in Table 2.16 associated with the construction of the Morgan Generation Assets together with up to 64.03 km^2 of temporary habitat disturbance/loss associated with the construction of the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (i.e. installation of OSPs and interconnector and export cables; Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd., 2023). The construction of the Morecambe Offshore Windfarms Generation Assets may result in up to 3.56 km^2 of temporary habitat disturbance (i.e. installation of OSPs, wind turbines and interconnector and inter-array cables; Morecambe Offshore Windfarm Ltd., 2023b).

A.1.1.1.20 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**.

Sensitivity of receptor

A.1.1.1.21 The sensitivity of the IEFs to temporary habitat loss/disturbance is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and in Table 2.19.

A.1.1.1.22 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

A.1.1.1.23 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).

Significance of effect

A.1.1.1.24 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the construction phase 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 2.6.2 and the matrix in Table 2.15, 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 2.9.2.12 to 2.9.2.20, 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.

Operations and maintenance phase

Magnitude of impact

A.1.1.1.25 The predicted cumulative temporary habitat loss/disturbance from the Morgan Generation Assets together with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm Generation Assets during the operations and maintenance phase would equate to up to 21.78 km^2. This includes all of the temporary habitat disturbance described in Table 2.16 associated with the operations and maintenance of the Morgan Generation Assets together with up to 10.26 km^2 of temporary habitat disturbance/loss associated with the operations and maintenance of the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (i.e. jack up events and repair and replacement for the interconnector and export cables; Morgan and Morecambe Offshore Windfarms Ltd., 2023). 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 Wind Ltd., 2023). This cumulative impact from the three projects will occur intermittently across the 35 year operational lifetime of the Transmission Assets.

A.1.1.1.26 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**.

Sensitivity of the receptor

A.1.1.1.27 The sensitivity of the IEFs to temporary habitat loss/disturbance is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and in Table 2.19.

A.1.1.1.28 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

A.1.1.1.29 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).

Significance of effect

A.1.1.1.30 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the operation and maintenance phase 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 significant in EIA terms. This conclusion has been reached based on the small area impacted in this phase and limited area of disturbance.

Decommissioning phase

Magnitude of impact

A.1.1.1.31 The predicted cumulative temporary habitat loss/disturbance from the Morgan Generation Assets together with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm Generation Assets during the decommissioning phase may result in similar levels of disturbance as in the construction phase (paragraph A.1.1.1.19). 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 Generation Assets.

A.1.1.1.32 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**.

Sensitivity of the receptor

A.1.1.1.33 The sensitivity of the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and in Table 2.19.

A.1.1.1.34 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

A.1.1.1.35 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).

Significance of effect

A.1.1.1.36 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the decommissioning phase 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 significant in EIA terms. This conclusion has been reached based on the small area impacted in this phase and limited area of substratum removal.

Scenario 3: Morgan Generation Assets together with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and all other relevant projects

Tier 1

Construction phase

Magnitude of impact

Subtidal habitat IEFs

A.1.1.1.37 Predicted cumulative temporary habitat loss/disturbance from each of the Tier 1 plans/projects/activities during the construction phase of the Morgan Generation Assets is presented in Table 2.27 together with a breakdown of the sources of this data from the relevant Environmental Statements and any assumptions made where necessary information was not presented in these Environmental Statements. Table 2.38 shows that for all projects/plans/activities in the Tier 1 assessment, the cumulative temporary habitat loss/disturbance during the construction phase of the Morgan Generation Assets together with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets is estimated at 202.23 km^2 (including the Morgan Generation Assets).

A.1.1.1.38 The maximum total temporary habitat loss/disturbance associated with all Tier 1 offshore wind farms (i.e. construction of Mona Offshore Wind Project, construction of the Awel y Môr Offshore Wind Farm, maintenance and decommissioning of the Barrow Offshore Wind Farm and the operations maintenance phases for the other offshore wind farm projects) within the CEA benthic subtidal ecology study area is 72.56 km^2. The values of temporary habitat loss for Morgan Generation Assets are comparably larger than for many of the other offshore wind farms presented in Table 2.38, as most of the Tier 1 projects will be in their operations and maintenance phases during the construction phase of the Morgan Generation Assets.

2.18.1.1 Temporary habitat loss/disturbance from Tier 1 dredge and disposal activities is likely to result in intermittent disturbance throughout the licenced periods resulting in the disturbance of approximately 4.22 km^2 of seabed over the construction phase and potentially beyond (Table 2.38). There are also a number of dredge licences without readily available environmental information (i.e. West of Duddon Sands Pontoon Dredging Marine Licence, maintenance dredging Peel Harbour Isle of Man, Douglas Harbour dredging Isle of Man and Heysham 1 and 2 dredging activities; see Table 2.38). The dredging is however of a small scale, at port locations at the edge of the Morgan CEA benthic subtidal ecology study area, and likely to be short term and intermittent throughout the Morgan Generation Assets construction phase affecting relatively small areas in comparison with the Morgan Generation Assets. 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.1.1.1.39 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.1.1.1.40 Additionally one oil and gas platform in the Morgan benthic CEA study area will be undergoing decommissioning during the construction phase of the Morgan 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 small and localised levels of disturbance to the seabed that will not significantly add to the total Tier 1 temporary habitat disturbance.

Table 2.38: Cumulative temporary habitat loss for the Morgan Generation Assets construction phase, the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and other Tier 1 plans/projects/activities in the CEA benthic subtidal ecology study area.

Project	Predicted temporary habitat disturbance/loss (km ^{2})	Component parts of temporary habitat disturbance/loss	Source
Morgan Generation Assets	61.42	See Table 2.16	n/a
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	64.03	Temporary habitat disturbance/loss may result from: • OSP foundation installation • Cable installation activities • Jack up events.	Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd (2023)
Offshore renewables			
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 Extension Offshore Wind Farm	Operations and maintenance: 0.24	Temporary habitat disturbance/loss may result from: • Jack-up events.	Dong Energy (2013a)
Walney 2 Offshore Wind Farm	Operations and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operations and maintenance phase has not been considered in this licence.	Dong Energy (2006)

Project	Predicted temporary habitat disturbance/loss (km ^{2})	Component parts of temporary habitat disturbance/loss	Source
Walney Offshore Wind Farm Operational Marine Licence - phase 2 export cable	0.01	Temporary habitat disturbance/loss may result from: • Cable repair/remediation.	Dong Energy (2014)
Walney 2 Offshore Wind farm – operations and maintenance marine licences (MLA/2017/00429/1)	0.24	Temporary habitat disturbance/loss may result from: • Jack-up events.	Dong Energy (2013a)
Walney Extension pontoon/jetty dredging and disposal	0.01	Temporary habitat disturbance/loss may result from: • Material deposition.	Orsted (2018)
West of Duddon Sands Offshore Wind Farm	Operations and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operations and maintenance phase has not been considered in this licence.	RSKENSR Ltd (2006)
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 (2016a)
Walney 1 Offshore Wind Farm	Operations and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operations 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 • Jack-up/moored vessels.	Dong Energy (2014) Marine Space (2017a) Dong Energy (2013b) Dong Energy (2016b)
Ormonde Offshore Wind Farm	Operations and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operations and maintenance phase has not been considered in this licence.	Eclipse Energy Company Ltd (2005)

Project	Predicted temporary habitat disturbance/loss (km ^{2})	Component parts of temporary habitat disturbance/loss	Source
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 • Jack-up events.	Marine Space (2015a) Vattenfall Wind Power Ltd (2016)
Barrow Offshore Wind Farm	Operations and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operations 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/2015/00077 and MLA/2016/00149/3)	0.07	Temporary habitat disturbance/loss may result from: • Jetting for cable repair and/or remediation works • Jack-up/moored vessels.	Marine Space (2015b) Dong Energy (2016a)
Awel y Môr Offshore Wind Farm	Construction: 10.02	Temporary habitat disturbance/loss may result from: • Jack-up events • Anchoring • Intertidal Horizontal Directional Drilling.	RWE (2022)
	Operations and maintenance: 0.26	Temporary habitat disturbance/loss may result from: • Cable repair/reburial	
Routine operations and maintenance activities at five Offshore Substations (Barrow, Ormonde, Lincs, Westermost Rough, and Gunfleet Sands)	No quantification provided.	Temporary habitat disturbance/loss may result from: • Removal of algal growth.	Transmission Capital Partners Ltd (2017)
Oil and Gas			
Isle of Man Crogga licence	No quantification provided.	Temporary habitat disturbance/loss may result from:	Isle of Man Government (2021)

Project	Predicted temporary habitat disturbance/loss (km ^{2})	Component parts of temporary habitat disturbance/loss	Source
		- Geophysical and geotechnical studies - Exploratory drilling.	
Millom West Platform- decommissioning	No quantification provided.	Temporary habitat disturbance/loss may result from: - Removal of platform infrastructure.	Burlington Resources (2016)
Dredging activities and dredge disposal sites			
Douglas Harbour dredging Isle of Man	No quantification provided.	Annual maintenance dredging of the harbour.	n/a
Port of Barrow maintenance dredging disposal licence.	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 not temporary habitat disturbance/loss values were provided	Associated British Ports (2016)
West of Duddon Sands Pontoon Dredging Marine Licence	No quantification provided.	Dredging of the channel leading to the maintenance facility.	n/a
Maintenance Dredging Peel Harbour Isle of Man	No quantification provided.	Maintenance dredging of the harbour.	n/a
Mersey channel and river maintenance dredge disposal renewal	0.50	Temporary habitat disturbance/loss may result from: - Dredging of silt and sand.	Royal Haskoning (2018)
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 not temporary habitat disturbance/loss values were provided	Royal Haskoning (2012)
Heysham 1 and 2 dredging activities	No quantification provided.	Dredging of the channel outside of the power station by the coolant outflow.	n/a
Remedial works			

Project	Predicted temporary habitat disturbance/loss (km ^{2})	Component parts of temporary habitat disturbance/loss	Source
Isle of Man Interconnector Cable - cable protection remedial works	No quantification provided.	Temporary habitat disturbance/loss may result from: • Anchoring • 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)
Total	202.232		

A.1.1.1.41 The cumulative effect is predicted to be of regional spatial extent, medium term duration (i.e. the construction phase for the Morgan Generation Assets is up to four years), intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **medium**.

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.1.1.42 The sensitivity of the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and above in Table 2.19.

A.1.1.1.43 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

A.1.1.1.44 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).

Significance of effect

Subtidal habitat IEFs

A.1.1.1.45 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the construction phase 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 2.6.2 and the matrix in Table 2.15, 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 2.9.2.12 to 2.9.2.20, 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.

Operations and maintenance phase

Magnitude of impact

A.1.1.1.46 Predicted cumulative temporary habitat loss/disturbance from each of the Tier 1 plans/projects/activities is presented in Table 2.39 together with a breakdown of the sources of this data from the relevant Environmental Statements and any assumptions made where necessary information was not presented in these Environmental Statements. Table 2.27 shows that, for all projects/plans/activities in the Tier 1 assessment, the cumulative temporary habitat loss/disturbance during the operations and maintenance phase of the Morgan Generation Assets and Morgan and Morecambe Offshore Windfarms: Transmission Assets is estimated at 58.76 km ^{2} (including the Morgan Generation Assets and Morgan and Morecambe Offshore Windfarms: Transmission Assets).

A.1.1.1.47 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 36.64 km^2. The values of temporary habitat loss for Morgan Generation Assets are comparably larger than for many of the other offshore wind farms presented in Table 2.39, 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.1.1.1.48 Additionally one oil and gas platform in the Morgan benthic CEA study area will be undergoing decommissioning during the operations and maintenance phase of the Morgan 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.1.1.1.49 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 Morgan Generation Assets (this value is the sum of all the offshore wind farm values in Table 2.39). 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 Morgan Generation 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.1.1.1.50 There are a number of cables and pipelines in the Morgan CEA benthic subtidal ecology study area, some of which will require maintenance during the construction phase of the Morgan Generation Assets. The one project scoped into this Tier 1 assessment, the Isle of Man Interconnector Cable, may require maintenance or remedial work to cables. 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 2.39: Cumulative temporary habitat disturbance for the Morgan Generation Assets and Morgan and Morecambe Offshore Windfarms: Transmission Assets operations and maintenance phase and other Tier 1 plans/projects/activities in the CEA benthic subtidal ecology study area.

Project	Predicted temporary habitat disturbance/loss (km ^{2})	Component parts of temporary habitat disturbance/loss	Source
Morgan Generation Assets	11.36	See Table 2.16	n/a
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	10.26	Temporary habitat disturbance/loss may result from: • OSP maintenance • Cable repair and reburial.	Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd (2023)
Offshore renewables			
Mona Offshore Wind Project	Operation and maintenance: 17.40	Temporary habitat disturbance/loss may result from: • Jack-up events • Wind turbine and OSP maintenance • Cable repair and reburial.	Mona Offshore Wind Ltd. (2024)
Walney Extension Offshore Wind Farm	Operations and maintenance: 0.24	Temporary habitat disturbance/loss may result from: • Jack-up events.	Dong Energy (2013a)
	Decommissioning: 1.43	Temporary habitat disturbance/loss may result from: • Jack-up events.	
Walney 2 Offshore Wind Farm	Operations and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operations 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 • 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.	Dong Energy (2013a)
Walney Extension pontoon/jetty dredging and disposal	0.01	Temporary habitat disturbance/loss may result from: • Material deposition.	Orsted (2018)
West of Duddon Sands Offshore Wind Farm	Operations and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operations 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.	
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 (2016a)
Walney 1 Offshore Wind Farm	Operations and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operations and maintenance phase has not been considered in this licence.	Dong Energy (2006)
	Decommissioning: 0.05	Temporary habitat disturbance/loss may result from: • Jack-up events • Foundation removal. • Scour protection removal	
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 • Jack-up/moored vessels.	Dong Energy (2014) Marine Space (2017a) Dong Energy (2013b) Dong Energy (2016b)
Ormonde Offshore Wind Farm	Operations and maintenance: No quantification provided.	Temporary habitat disturbance/loss in the operations and maintenance phase has not been considered in this licence.	Eclipse Energy Company Ltd (2005)

Project	Predicted temporary habitat disturbance/loss (km ^{2})	Component parts of temporary habitat disturbance/loss	Source
	Decommissioning: 5.25	Temporary habitat disturbance/loss may result from: • Removal of wind turbines • 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 • Jack-up/moored vessels.	Marine Space (2015a) Vattenfall Wind Power Ltd (2016)
Awel y Môr Offshore Wind Farm	Operations and maintenance: 0.26	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 • Anchoring.	
Routine operations and maintenance activities at five Offshore Substations (Barrow, Ormonde, Lincs, Westermost Rough, and Gunfleet Sands)	No quantification provided.	Temporary habitat disturbance/loss may result from: • Removal of algal growth.	Transmission Capital Partners Ltd (2017)
Oil and Gas			
Isle of Man Crogga licence	No quantification provided.	Temporary habitat disturbance/loss may result from: • Geophysical and geotechnical studies • Exploratory drilling.	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)
Dredging activities and dredge disposal sites			
Douglas Harbour dredging Isle of Man	No quantification provided.	Annual maintenance dredging of the harbour.	n/a
Maintenance Dredging Peel Harbour Isle of Man	No quantification provided.	Maintenance dredging of the harbour.	n/a

Project	Predicted temporary habitat disturbance/loss (km ^{2})	Component parts of temporary habitat disturbance/loss	Source
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)
Cables and pipelines			
Remedial works			
Isle of Man Interconnector Cable - cable protection remedial works	No quantification provided.	Temporary habitat disturbance/loss may result from: • Anchoring • 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)
Total	58.76		

A.1.1.1.51 The cumulative effect is predicted to be of regional spatial extent, medium term duration (some of the decommissioning works may take a few years however most of the maintenance activities are likely to occur over a period of days to weeks, over the lifetime of the projects), intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.1.1.52 The sensitivity of the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and above in Table 2.19.

A.1.1.1.53 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

A.1.1.1.54 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).

Significance of effect

Subtidal habitat IEFs

A.1.1.1.55 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna communities IEF the magnitude of the cumulative temporary habitat disturbance impact during the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Decommissioning phase

A.1.1.1.56 During the decommissioning phase of the Morgan Generation Assets and Morgan and Morecambe Offshore Windfarms: Transmission Assets the Mona Offshore Wind Project will also be in its decommissioning phase. The maximum total temporary habitat disturbance/loss associated with the Mona Offshore Wind Project within the Morgan CEA subtidal ecology study area within the decommissioning phase is estimated to be the same as for the construction phase (paragraphs A.1.1.1.37 to A.1.1.1.41). 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.1.1.1.57 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.

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.1.1.58 The sensitivity of the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and above in Table 2.19.

A.1.1.1.59 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be medium.

A.1.1.1.60 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be high (and reduced to medium in the absence of seapens).

Significance of effect

Subtidal habitat IEFs

A.1.1.1.61 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.

Tier 2

Construction phase

Magnitude of impact

Subtidal habitat IEFs

A.1.1.1.62 The maximum total temporary habitat disturbance/loss associated with the Tier 2 projects includes the Morecambe Offshore Windfarm Generation Assets, 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 208.93 km^2 (Table 2.40).

A.1.1.1.63 For the Morecambe Offshore Windfarm Generation Assets, the predicted temporary habitat loss/disturbance the construction phase is estimated at 3.46 km^2. This includes the installation of wind turbines, OSPs and inter-array and interconnector cables for the Morecambe Offshore Windfarm Generation Assets as well as jack-up events (Morecambe Offshore Windfarm Ltd., 2023).

A.1.1.1.64 The Liverpool Bay area 457 aggregate extraction site may be licenced during the construction phase of the Morgan Generation 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). The Liverpool Bay area 457 aggregate extraction site extends over 64.8 km^2 (Westminster Gravels Ltd, 2023) however only a fraction of this will be operational at any one time resulting in 3.24 km^2 of temporary habitat disturbance/loss. For the purposes of this assessment, the MDS assumes that a precautionary 5% of the proposed total licensed area of Liverpool Bay area 457 will be actively dredged during this period.

A.1.1.1.65 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 Morgan Generation Assets.

Table 2.40: Cumulative temporary habitat loss/disturbance for the Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets construction phase and other Tier 2 plans/projects/activities in the CEA benthic subtidal ecology study area.

Project	Predicted temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
Morgan Generation Assets	61.42	See Table 2.16	See Table 2.16

Project	Predicted temporary habitat disturbance/loss (km²)	Component parts of temporary habitat disturbance/loss	Source
Other Tier 1 projects	79.78	See Table 2.38	See Table 2.38
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	64.03	Temporary habitat disturbance/loss may result from: • OSP foundation installation • Cable installation activities • Jack up events.	Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd (2023)
Offshore renewables			
Morecambe Offshore Windfarm Generation Assets	3.46	Temporary habitat disturbance/loss may result from: • Wind turbine and OSP foundation installation • Cable installation activities • Jack up events.	Morecambe Offshore Windfarm Ltd. (2023b)
ENI Hynet CCS	No quantification provided.	Temporary habitat disturbance/loss may result from: • Site preparation • Cable installation • Maintenance activities.	Liverpool Bay CCS Ltd (2022)
Deposits and removals			
Liverpool Bay aggregate extraction area 457	3.24	Temporary habitat disturbance/loss may result from: • Aggregate extraction.	Westminster Gravels Ltd (2023)
Total	208.93		

A.1.1.1.66 The cumulative effect on the subtidal habitat IEFs is predicted to be of regional spatial extent, medium term duration (i.e. the construction phase for the Morgan Generation Assets is up to four years), intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **medium**.

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.1.1.67 The sensitivity of the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and above in Table 2.19.

A.1.1.1.68 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

A.1.1.1.69 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).

Significance of effect

Subtidal habitat IEFs

A.1.1.1.70 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the construction phase 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 2.6.2 and the matrix in Table 2.15, 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 2.9.2.12 to 2.9.2.20, 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.

Operations and maintenance phase

Magnitude of impact

Subtidal habitat IEFs

A.1.1.1.71 The maximum total temporary habitat disturbance/loss associated with the Tier 2 assessment includes two offshore renewables projects within the CEA benthic subtidal ecology study area (i.e. Morecambe Offshore Windfarm Generation Assets and the Morgan and Morecambe Offshore Wind Farms: Transmission Assets). The maximum total temporary habitat disturbance/loss associated with the Tier 2 assessment during the operations and maintenance phase is estimated at up to 62.16 km^2 (see Table 2.41).

A.1.1.1.72 For the Morecambe Offshore Windfarm Generation Assets, the predicted cumulative temporary habitat loss/disturbance during the operations and maintenance phase would equate to 0.16 km^2. This includes jack up events and cable repair and replacement activities (Morecambe Offshore Windfarm Ltd., 2023). For this impact on both projects the impact will occur intermittently across the 35-year life span of the projects.

A.1.1.1.73 The Liverpool Bay area 457 aggregate extraction site may be licenced during the operations and maintenance phase of the Morgan Generation Assets. An environmental statement 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). The Liverpool Bay area 457 aggregate extraction site extends over 64.8 km^2 (Westminster Gravels Ltd, 2023) however only a fraction of this will be operational at any one time resulting in up to 3.24 km^2 of temporary habitat disturbance/loss. For the purposes of this assessment, the MDS assumes that a precautionary 5% of the proposed total licensed area of Liverpool Bay area 457 will be actively dredged during this period.

A.1.1.1.74 A scoping report is available for the ENI Hynet CCS project which outlines the impact on benthic ecology from temporary habitat disturbance/loss in its construction phase 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 Limited, 2022). In its operations and maintenance phase the project may contribute to temporary habitat loss through device repair, cable repair and vessel anchoring. The scoping report does not however provide estimates of habitat disturbance with which to make any quantitative assessment of the cumulative impact with the Morgan Generation Assets.

A.1.1.1.75 A scoping report is also 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).

Table 2.41: Cumulative temporary habitat loss/disturbance for the Morgan Generation Assets and Morgan and Morecambe Offshore Wind Farms: Transmission Assets operation and maintenance phase and other Tier 2 plans/projects/activities in the CEA benthic subtidal ecology study area.

Project	Predicted temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
Morgan Generation Assets	11.36	See Table 2.16	See Table 2.16
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	10.26	Temporary habitat disturbance/loss may result from: • OSP maintenance • Cable repair and reburial.	Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd (2023)
Other Tier 1 projects	37.14	See Table 2.39	See Table 2.39
Offshore renewables			
Morecambe Offshore Windfarm Generation Assets	0.16	Temporary habitat disturbance/loss may result from: • Wind turbine and OSP maintenance • Cable repair and reburial.	Morecambe Offshore Windfarm Ltd. (2023b)
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	10.26	Temporary habitat disturbance/loss may result from:	Morecambe Offshore Windfarm Ltd and Morgan Offshore Wind Ltd (2023)

Project	Predicted temporary habitat disturbance/loss (km^2)	Component parts of temporary habitat disturbance/loss	Source
		• OSP maintenance • Cable repair and reburial.	
Mooir Vannin Offshore Windfarm	No quantification provided.	Temporary habitat disturbance/loss may result from: • Wind turbine and OSP foundation installation • Cable installation activities • Maintenance activities.	Ørsted (2023)
ENI Hynet CCS	No quantification provided.	Temporary habitat disturbance/loss may result from: • Site preparation • Cable and pipeline installation • Maintenance works.	Liverpool Bay CCS Limited (2022)
Deposits and removals			
Liverpool Bay aggregate extraction area 457	3.24	Temporary habitat disturbance/loss may result from: • Aggregate extraction.	Westminster Gravels Ltd (2023)
Total	62.16		

A.1.1.1.76 The cumulative effect is predicted to be of regional spatial extent, short term duration (the maintenance activities are likely to occur over a period of days to weeks, over the lifetime of the projects), intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.1.1.77 The sensitivity of the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and above in Table 2.19.

A.1.1.1.78 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

A.1.1.1.79 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).

Significance of effect

Subtidal habitat IEFs

A.1.1.1.80 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Decommissioning phase

Magnitude of impact

A.1.1.1.81 During the decommissioning phase of the Morgan Generation Assets all Tier 2 projects (i.e. Morecambe Offshore Windfarm Generation Assets, 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 Morgan CEA subtidal ecology study area within the decommissioning phase is estimated to be the same as for the construction phase (paragraphs A.1.1.1.62 to A.1.1.1.65) with the addition of the Mooir Vannin maintenance activities (as described in paragraph A.1.1.1.75). 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.1.1.1.82 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**.

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.1.1.83 The sensitivity of the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and above in Table 2.19.

A.1.1.1.84 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

A.1.1.1.85 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).

Significance of effect

Subtidal habitat IEFs

A.1.1.1.86 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the decommissioning phase is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Tier 3

Construction phase

Magnitude of impact

Subtidal habitat IEFs

A.1.1.1.87 The only Tier 3 project which has been identified in the CEA with the potential to result in cumulative temporary habitat loss/disturbance during the operations and maintenance phase of the Morgan Generation Assets is the MaresConnect interconnector cable. There is, however, currently no information on the impact that the MaresConnect interconnector cable will have on benthic ecology receptors; a planning application is predicted to be submitted in 2024 which will identify and assess these impacts (MaresConnect, 2022).

A.1.1.1.88 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 Morgan Generation 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.1.1.1.89 The cumulative impact 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 **medium**.

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.1.1.90 The sensitivity of the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and above in Table 2.19.

A.1.1.1.91 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

A.1.1.1.92 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).

Significance of effect

Subtidal habitat IEFs

A.1.1.1.93 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the construction phase 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 2.6.2 and the matrix in Table 2.15, 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 2.9.2.12 to 2.9.2.20, 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. The cumulative effect will, therefore, be of **moderate** adverse significance in the short to medium term, with this decreasing to **minor** adverse significance in the long term as the sediments and associated benthic communities recover. Therefore, effects of minor adverse significance are predicted in the long term which is not significant in EIA terms.

Operations and maintenance phase

Magnitude of impact

Subtidal habitat IEFs

A.1.1.1.94 The only Tier 3 project which has been identified in the CEA with the potential to result in cumulative temporary habitat loss/disturbance during the operations and maintenance phase of the Morgan Generation Assets is the MaresConnect interconnector cable. There is, however, currently no information on the impact that the MaresConnect interconnector cable will have on benthic ecology receptors, a planning application is predicted to be submitted in 2024 which will identify and assess these impacts (MaresConnect, 2022).

A.1.1.1.95 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 Morgan Generation 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. Maintenance activities are likely to involve the repair and reburial of cables.

A.1.1.1.96 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**.

Sensitivity of the receptor

Subtidal habitat IEFs

A.1.1.1.97 The sensitivity of the IEFs is as described previously for the Morgan Generation Assets alone assessment in paragraph 2.9.2.12 to 2.9.2.15 and above in Table 2.19.

A.1.1.1.98 The subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF and subtidal coarse and mixed sediments with diverse benthic communities IEF are deemed to be of overall high vulnerability, medium recoverability and national value. The sensitivity of the receptor is therefore, considered to be **medium**.

A.1.1.1.99 The seapens and burrowing megafauna communities IEF is deemed to be of high vulnerability, low to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be **high** (and reduced to **medium** in the absence of seapens).

Significance of effect

Subtidal habitat IEFs

A.1.1.1.100 Overall, for the subtidal sand and muddy sand sediments with benthic communities dominated by *Lagis koreni* and other polychaetes IEF, subtidal coarse and mixed sediments with diverse benthic communities IEF and seapens and burrowing megafauna IEF the magnitude of the cumulative temporary habitat disturbance/loss impact during the operations and maintenance phase is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Decommissioning phase

A.1.1.1.101 There are no Tier 3 projects active in the Morgan Generation Assets decommissioning phase to consider for cumulative impacts based on current knowledge.