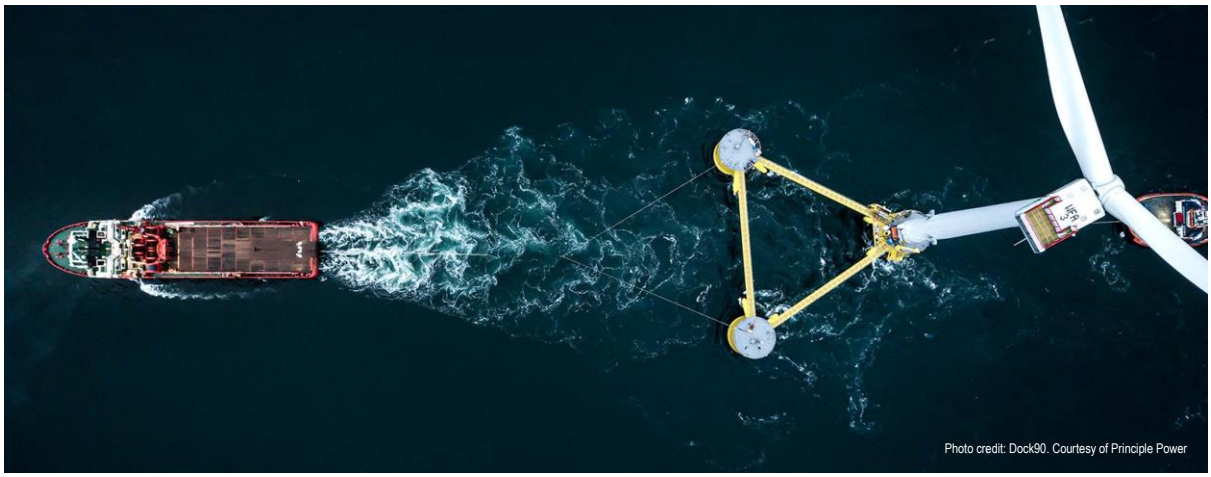

Project Erebus Environmental Statement
Chapter 9: Marine and Coastal Ecology

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Acronyms

Term	Definition
AEoSI	Adverse Effect on Site Integrity
BGW	Blue Gem Wind
BIIGLE	Bio-Image Indexing and Graphical Labelling Environment
BSH	Broadscale Habitat
CALM	Coastal Assessment, Liaison and Monitoring
CCW	Countryside Council for Wales (now NRW)
CoCP	Code of Construction Practice
DDC	Drop Down Camera
DDV	Drop Down Video
EA	Environment Agency
EBS	Environmental Baseline Survey
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMMP	Environmental Mitigation and Management Plan
EMODnet	European Marine Observation and Data Network
ES	Environmental Statement
EUNIS	European Nature Information System
FLOW	Floating Offshore Windfarm
FOCI	Features of Conservation Interest
HA	Habitat Assessment
HDD	Horizontal Directional Drill
HPI	Habitats of Principal Importance
HRA	Habitats Regulations Assessment
INNS	Invasive Non-Native Species
JNCC	Joint Nature Conservation Committee
km	Kilometre(s)

Term	Definition
KP	Kilometre Point
kV	Kilovolt
LAT	Lowest Astronomical Tide
LDP	Local Development Plan
m	Metres
MarLIN	Marine Life information Network
MarESA	Marine Evidence-based Sensitivity Assessment
MFE	Mass Flow Excavator
MHWS	Mean High Water Springs
MLWS	Mean Low Water Neaps
MNCR	Marine Nature Conservation Review (Marine Habitat Classification for Britain and Ireland)
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
MPS	Marine Policy Statement
MSFD	Marine Strategy Framework Directive
NERC	Natural Environment and Rural Communities
nm	Nautical Mile
NPS	National Policy Statement
NRW	Natural Resources Wales
OEL	Ocean Ecology Limited
O&M	Operation and Maintenance
OSPAR Convention	Convention for the Protection of the Marine Environment of the North-East Atlantic
PDE	Project Design Envelope
PEL	Probable Effect Level
RIAA	Report to Inform Appropriate Assessment
SAC	Special Area of Conservation
SBE	Simply Blue Energy
SIMPROF	Similarity Profile Routine

Term	Definition
SSC	Suspended Sediment Concentration
SSSI	Site of Special Scientific Interest
TEL	Threshold Effect Level
TOM	Total Organic Matter
UAV	Unmanned Aerial Vehicle
UK	United Kingdom
UKBAP	UK Biodiversity Action Plan
µT	Microtesla
VER	Valued Ecological Receptor
WNMP	Wales National Marine Plan
WFD	Water Framework Directive
WTG	Wind Turbine Generator

Chapter 9 Marine and Coastal Ecology

9.1 Introduction

9.1.1.1 The proposed Project Erebus (the Project) is a demonstration scale Floating Offshore Wind (FLOW) development in the Celtic Sea region. The Applicant, Blue Gem Wind, is a joint venture between Simply Blue Energy (SBE) and TotalEnergies, set up to create a new low carbon offshore energy sector in the region; that contributes to climate change targets, supply chain diversification and energy security.

9.1.1.2 The array area is located approximately 35 km southwest of the Pembrokeshire coastline, covering an area of 43.5 km^2 in water depths of between 65-85 m. The array area is located outside of the 12 nm limit, but all elements of the Project, array area, offshore export cable corridor and landfall, fall within Welsh territorial waters or the Welsh Zone.

9.1.1.3 The Project comprises six to ten Wind Turbine Generators (WTG) with a total generating capacity up to 100 MW. Each WTG is housed on a semi-submersible floating platform with a mooring system comprising a maximum of five catenary mooring lines, up to 870 m in length, and a range of foundation options including drag embedment anchors, driven piles, drilled piles and/or suction piles. Up to 10 dynamic array cables are proposed, with a lazy wave configuration from the semi-submersible floating platform to the seabed. The offshore export cable, up to 49 km in length, links the array area to landfall at West Angle Bay, Pembrokeshire.

9.1.1.4 The Study Area for the benthic ecology assessment is defined in Section 9.4.3 (also see Volume 2, Figure 9.1). Chapter 3: Site Selection and Alternatives details fully the wide range of studies undertaken to inform the site-selection process for the Project.

9.1.1.5 This chapter provides a description of the existing baseline environment with regard to marine and coastal benthic ecology (Section 9.5). Ocean Ecology Ltd (OEL) was commissioned by Rovco, on behalf of the Applicant to undertake project-specific intertidal and subtidal benthic ecological surveys in Autumn 2020. Additional geophysical surveys were undertaken by Geoxyz in February-April 2021 across the array area, to provide a more complete coverage of the area. As part of this assessment, MarineSpace reviewed OEL's benthic habitat interpretations based on the 2020 data, against the 2021 geophysical dataset, to update the original baseline, where required. This review is presented in Volume 3, Technical Appendix 9.1: Integrated report (Geophys and Habitat Assessment), Annex 2: Erebus Array Habitat Review.

9.1.1.6 In addition, in May 2021, Coastal Assessment Liaison and Monitoring (CALM) was commissioned by MarineSpace, on behalf of the Applicant, to undertake a focused, site specific, snorkelling survey in the shallow sublittoral area of West Angle Bay. The outputs of this survey enabled a continuous link between spatial biotope data from the subtidal, through to the intertidal area at the landfall site of West Angle Bay. The data from these surveys, combined with existing information gathered via an initial desk-based literature review, have been used to characterise the baseline environment of the Study Area and inform this assessment.

9.1.1.7 Additional assessment is provided for potential effects of the Proposed Development during the construction, operation and decommissioning phases (Section 9.6). Where the potential for significant effects is identified, mitigation measures are presented (Section 9.7).

9.1.1.8 This chapter has been informed by the following:

- Chapter 4: Proposed Development Description;

- Chapter 6: Marine and Coastal Processes;
- Chapter 7: Marine Seabed and Water Quality;
- Chapter 15: Commercial Fisheries;
- Volume 3, Technical Appendix 6.1: Marine and Coastal Processes Assessment;
- Volume 3, Technical Appendix 7.2: Electromagnetic Field Assessment;
- Volume 3, Technical Appendix 9.1: Integrated report (Geophys and Habitat Assessment)
- Volume 3, Technical Appendix 9.1, Annex 1: West Angle Bay, Survey of Shallow Subtidal Habitats
- Volume 3, Technical Appendix 9.1, Annex 2: Erebus Array Habitat Review.
- Volume 3, Technical Appendix 9.2: Environmental Baseline Report;
- Volume 3, Technical Appendix 9.3: Intertidal Habitat Report;
- Volume 3, Technical Appendix 9.4: Invasive Non-Native Species Plan;
- Consultation with, and pre-application regulatory advice received from Natural Resources Wales (NRW) and Joint Nature Conservation Committee (JNCC);
- Consideration of the existing evidence base regarding the effects of Project infrastructure on the subtidal; and
- Application of expert-based assessment and judgement by MarineSpace.

9.1.1.9 This chapter also utilises and builds upon the information presented in the Project Erebus EIA Scoping Report (MarineSpace Ltd, 2019) and in the formal EIA Scoping Opinion (NRW, 2020). Copies of the Scoping Opinion Request (the Scoping Report) and Natural Resource Wales' (NRW's) Scoping Opinion are provided in Volume 3, Technical Appendices 2.1 and 2.2, respectively.

9.1.1.10 The potential impacts on benthic receptors have been assessed conservatively using realistic worst-case scenarios for the Project for each impact. The Project Design Envelope (PDE) is provided in full in Chapter 4: Proposed Development Description.

9.1.1.11 This chapter should also be read in conjunction with Chapter 6: Marine and Coastal Processes and Chapter 7: Marine Seabed and Water Quality.

9.1.1.12 This chapter has been prepared by MarineSpace, on behalf of the Applicant. This assessment has been carried out by MarineSpace Limited (MarineSpace), the lead offshore Environmental Impact Assessment (EIA) Consultants. The chapter has been authored by Marja Aberson who has over 15 years' experience as a marine professional.

9.2 Legislation, Policy and Guidelines

9.2.1 Overview

9.2.1.1 This section outlines the relevant international, national and regional policy and guidelines, and industry guidelines which have been used to support the compilation of this chapter. A detailed overview of the relevant policy and legislation for the Project is provided in Chapter 5: Policy and Legislation.

9.2.1.2 The Project is seeking a Section 36 consent with deemed planning permission under the Electricity Act 1989 from Welsh Ministers, and a Marine Licence under the Marine and Coastal Access Act (MCAA) 2009 from Natural Resources Wales (NRW).

9.2.2 Legislation

9.2.2.1 A range of policies, plans and legislation have been taken into account as part of this assessment. Those of particular relevance are:

- EU Habitats Directive (Directive 92/43/EEC);
- Marine Strategy Framework Directive (MSFD);
- The Convention of the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention 1992);
- Maritime Spatial Planning Directive (EU Directive 2014/89) (MSPD);
- Water Framework Directive (WFD) (EU Directive 2000/60/EC);
- Environmental Assessments and Miscellaneous Planning (Amendment) (EU Exit) Regulations 2018;
- Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2017;
- The Conservation of Habitats and Species Regulations 2017 (applies to terrestrial and territorial waters out to 12 nm);
- The Conservation of Offshore Marine Habitats and Species Regulations 2017 (Habitats Regulations) (apply to UK's offshore water area (i.e. from 12 nm from the coast out to 200 nm or to the limit of the UK Continental Shelf Designated Area);
- Water Environment (Water Framework Directive) (England and Wales) Regulations 2017;
- Marine Act 2010 and Marine and Coastal Access Act (MCAA) (2010);
- UK Post-2010 Biodiversity Framework, superseding the UK Biodiversity Action Plan (BAP), the UK Government's response to the Convention on Biological Diversity (CBD) 1992
- The Wales Act 2017;
- Environment (Wales) Act 2016 Section 7;
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- The Wildlife and Countryside Act (WCA) 1981;
- Wellbeing of Future Generations (Wales) Act 2015;
- Welsh National Marine Plan (WNMP) (Welsh Government, 2019);
- Milford Haven Conservancy Act 1983; and
- Pembrokeshire Local Development Plan (LDP) (2013) (Pembrokeshire County Council, 2013).

9.2.2.2 Other relevant legislation and policies has also been considered during this assessment (see Chapter 5: Policy and Legislation).

EU Habitats Directive

9.2.2.3 The EU Habitat Directive (Directive 92/43/EEC) lists 13 marine habitats and eight marine species in Annexes I and II, respectively. In order to meet Article 3 of the Directive and to contribute to the European network of conservation sites, Special Areas of Conservation (SAC) have been designated in UK waters under the Habitats Regulations 2017 (JNCC, 2020) for the protection of Annex I and/or Annex II.

9.2.2.4 There are two SACs with marine and/or coastal features overlapping with the Study Area of the Project and one located approximately 4 km from the export cable corridor (ECC) and landfall:

- Sir Benfro Forol/Pembrokeshire Marine SAC (UK0013116);
- Gorllewin Cymru Forol/West Wales Marine SAC (UK0030396); and
- Afordir Calchfaen de Orllewin Cymru/Limestone Coast of South West Wales SAC (UK0014787).

9.2.2.5 For benthic ecology, consideration will be given to the Sir Benfro Forol / Pembrokeshire Marine SAC as it overlaps the Study Area and contains designated benthic ecological features. Section 9.5.3 provides details on the SAC, its designated features, and known and predicted spatial distribution within the site.

9.2.2.6 Chapter 8: Offshore Designated Sites provides a summary description of all three SAC's listed above, and Chapter 10: Fish and Shellfish Ecology, Chapter 12: Marine Mammals, and Volume 3, Technical Appendix 8.3: Report to Inform Appropriate Assessment consider the relevant SACs that support mobile features (e.g. cetaceans, pinnipeds and migratory fish):

- Gorllewin Cymru Forol/West Wales Marine SAC;
- Lundy SAC;
- Bae Ceredigion Bae/Cardigan Bay SAC;
- Saltee Islands SAC;
- Pen Llŷn a'r Sawnau/Llyn Peninsular and the Sarnau SAC;
- Dynesfeydd Môr Hafren/Bristol Channel Approach SAC; and
- Afondydd Cleddau/Cleddau Rivers SAC.

OSPAR Convention 1992

9.2.2.7 The OSPAR List of Threatened and/or Declining Species and Habitats in the North-East Atlantic has been developed to meet the commitment of the OSPAR strategy for the Protection and Conservation of Ecosystems and Biological Diversity (OSPAR Commission, 2021). Some of these species and habitats are also afforded protection under Section 7 of the Environment (Wales) Act (2016).

9.2.2.8 Consideration will be given to the potential presence of benthic OSPAR threatened and/or declining species and habitats that may be present within the Study Area. Section 9.5.3 provides details on these and known and predicted spatial distribution within the area.

The Conservation of Habitats and Species Regulations 2017 and The Conservation of Offshore Marine Habitats and Species Regulations 2017

9.2.2.9 Following the UK's exit from the EU and end of transition period on 31 December 2020, various pieces of legislation have been passed to remove the domestic constitutional basis for EU law in the UK. This includes changes to the 2017 Habitats Regulations through The Conservation of Habitats and Species and Planning (Various Amendments) (England and Wales) Regulations 2018 and the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019. The amendments were applied to provide legal certainty and minimise disruption immediately following EU exit. Overall, the legislative changes do not result in material changes in how Habitat Regulations Assessment (HRAs) are undertaken in the UK.

Environment (Wales) Act 2016

9.2.2.10 The Environment (Wales) Act 2016 sets out the requirement for the *'sustainable management of natural resources.'* Section 6 Duty under Part 1 of the Environment (Wales) Act 2016, requires that public authorities must seek to maintain and enhance biodiversity to promote the resilience of ecosystems (Wales Biodiversity Partnership, 2021).

9.2.2.11 UK Biodiversity Action Plan (UK BAP) priority habitats are identified as being the most threatened and requiring action under the UK BAP. As a result of devolution, the UK Biodiversity Action Plan (UK BAP) is focussed on a country-level, and the UK BAP was superseded by the 'UK post-2010 Biodiversity Framework' in July 2012 (JNCC, 2021a).

9.2.2.12 Section 7 of The Environment (Wales) Act (2016) requires that Welsh Ministers 'prepare and publish a list of the living organisms and types of habitat' that are of 'principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales'. This Section 7 biodiversity list duty supersedes the biodiversity duty in Section 42 of the Natural Environment and Rural Communities (NERC) Act 2006. Some of the marine benthic habitats and species listed are also afforded protection under OSPAR (Welsh Government, 2021).

9.2.2.13 Consideration will be given to the potential presence of benthic Section 7 Habitats/Species of Principal Importance (HPI/SPI) (formally BAP/Section 42) that may be present within the Study Area.

9.2.3 Policy

National Policy Statements

9.2.3.1 Although this Project is seeking Section 36 consent under the Electricity Act 1989 and a Marine Licence under the Marine and Coastal Access Act (MCAA) 2009, as opposed to a Development Consent Order (DCO), its size (up to 100 MW) is similar to the minimum threshold (100 MW) for Nationally Significant Infrastructure Projects (NSIPs). As such, guidance relevant to NSIPs is considered relevant to use for this Project. National Policy Statements (NPSs) were developed to provide guidance in the determination of NSIPs. Those relevant for the assessment of impacts on marine ecology include[1]:

- Overarching National Policy Statement (NPS) for Energy (EN-1) (Department of Energy and Climate Change (DECC), 2011a); and
- NPS for Renewable Energy Infrastructure (EN-3), July 2011 (DECC, 2011b).

9.2.3.2 Even though the NPSs listed above specifically relate to Nationally Significant Infrastructure Projects (NSIP), and the Project is not classified as an NSIP, a review of EN-1 and EN-3 has still been undertaken.

9.2.3.3 Details of specific policies within EN-1 and EN-3 used to inform this assessment are provided in Table 9.1 below. The specific assessment requirements for benthic ecology are detailed, together with an indication of the paragraph numbers of the chapter where each is addressed.

[1] A period of consultation on a set of revised energy NPS's, managed by the Department of Business, Energy and Industrial Strategy (BEIS), ended on 29th November 2021.

Table 9.1 – NPS EN-1 and EN-3 Assessment Provisions Relevant to Benthic Ecology

NPS Requirement	NPS Reference	ES Reference
Where the development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity. The applicant should provide environmental information proportionate to the infrastructure where EIA is not required to help the IPC consider thoroughly the potential effects of a proposed project.	EN-1, Section 5.3.3	The designated sites relevant to the assessment are outlined in Section 9.5.3.
Applicants should assess the potential for the scheme to have both positive and negative effects on marine ecology and biodiversity.	EN-3, Section 2.6.67	Potential impacts of the Project on benthic ecology are presented in Section 9.6.
Mitigation may be possible in the form of a careful design of the development itself and the construction techniques employed.	EN-3, Section 2.6.70	Standard and additional mitigation measures are outlined in Section 9.4.9.
An assessment of the effects of installing cable across the intertidal zone should include information, where relevant, about: • Any alternative landfall sites that have been considered by the applicant during the design phase and an explanation for the final choice; • Any alternative cable installation methods that have been considered by the applicant during the design phase and an explanation for the final choice; • Potential loss of habitat; • Disturbance during cable installation and removal (decommissioning); • Increased suspended sediment loads in the intertidal zone during installation; and • Predicted rates at which the intertidal zone might recover from temporary effects.	EN-3, Section 2.6.81	Potential impacts of the Proposed Development on intertidal benthic and marine ecology are presented in Section 9.6. Potential impacts of the Project on ecology at the landfall, above Mean High Water, are presented in Chapter 20: Terrestrial and Coastal Ecology and Onshore Ornithology.
Applicants are expected to have regard to guidance issued in respect of Food and Environmental Protection Act (FEPA) [now Marine Licence] requirements.	EN-3, Section 2.6.83	Other relevant guidance, including in respect to the Marine Licence, is outlined further in Section 9.2.3.4.

NPS Requirement	NPS Reference	ES Reference
Where necessary, assessment of the effects on the subtidal environment should include: • Loss of habitat due to foundation type including associated sea bed preparation, predicted scour, scour protection and altered sedimentary processes • Environmental appraisal of array cables and cable routes and installation methods; • Habitat disturbance from construction vessels' extendible legs and anchors; • Increased suspended sediment loads during construction; and Predicted rates at which the subtidal zone might recover from temporary effects.	EN-3, Section 2.6.113	Potential impacts of the Project on benthic ecology are presented in Section 9.6.
Construction and decommissioning methods should be designed appropriately to minimise effects on subtidal habitats, taking into account other constraints. Mitigation measures which the Infrastructure Planning Commission (IPC) (now the Planning Inspectorate) should expect the applicants to have considered may include: • Surveying and micrositing of the export cable route to avoid adverse effects on sensitive habitat and biogenic reefs; • Burying cables at a sufficient depth, taking into account other constraints, to allow the seabed to recover to its natural state; and • The use of anti-fouling paint might be minimised on subtidal surfaces, to encourage species colonisation on the structures.	EN-3 Section 2.6.119	Potential construction, operation, and decommissioning impacts of the Project on benthic ecology are presented in Sections 9.6.2, 9.6.3, and 9.6.4.
Activities should have been designed, taking into account sensitive benthic environmental aspects and intertidal habitats	EN-3, Section 2.6.116	Details of the existing environment are provided in Section 9.5 and mitigation measures where necessary are provided in Section 9.6.2, 9.6.3, and 9.6.4.
Where adverse effects are predicted, the assessment should consider the extent to which the effects are temporary or reversible. This includes the installation and decommissioning of cables.	EN-3, Section 2.6.117	The magnitude of each impact, which includes the extent to which the effects are temporary or reversible, has been considered in Sections 9.6.2, 9.6.3, and 9.6.4.

UK Marine Policy Statements

9.2.3.4 The UK Marine Policy Statement (MPS) (HM Government, 2011) adopted by all UK administrations in March 2011, provides the policy framework for the preparation of marine plans and establishes how decisions affecting the marine area should be made in order to enable sustainable development. The MPS sets out a vision of having "*clean, healthy, safe, productive and biologically diverse oceans and seas"* by supporting the development of Marine Plans. It also sets out the framework for environmental, social and economic considerations that need to be considered in marine planning.

9.2.3.5 Table 9.2 sets out other national MPS policies which are particularly relevant to benthic ecology.

Table 9.2 – Other MPS Policy Provisions Relevant to Benthic Ecology

MPS Policy Descriptions	Reference	ES Reference
Noise resulting from a proposed activity or development in the marine area or in coastal and estuarine waters can have adverse effects on biodiversity although knowledge of the extent of impacts is limited and there are few systematic monitoring programmes to verify adverse effects. Man-made sound emitted within the marine environment can potentially affect marine organisms in various ways. It has the potential to mask biologically relevant signals; it can lead to a variety of behavioural reactions, affect hearing organs and injure or even kill marine life. Manmade sound sources of primary concern with regard to disturbance of marine life are explosions, shipping, seismic surveys, offshore construction and offshore industrial activities, for example dredging, drilling and piling, sonar of various types and acoustic deterrent devices.	Section 2.6.3.1	Indirect noise impacts arising from the Project have been assessed on fish, birds and marine mammals. Please see Chapters 10: Fish and Shellfish, Chapter 11: Offshore Ornithology and Chapter 12: Marine Mammals.
The UK Administrations are committed to allowing damaged ecosystems to recover in order to realise the benefits from the marine environment. This will be achieved through integrating conservation objectives into marine planning and decision making and incorporating the requirements for specific designated conservation areas.	Section 3.1.1	Designated sites are presented in Section 9.5.3 and protected habitats and species recorded across the Survey Area are discussed in Section 9.5.5. These are considered fully within the impact assessment (Section 9.6).
A number of SSSIs extend into the marine environment primarily the inter-tidal zone. The statutory protection afforded to SSSIs, and the procedures to be followed with regard to development proposals that may affect them, are detailed in Wildlife and Countryside legislation.	Section 3.1.5	The Arfordir Penryn Angle/Angle Peninsular Coast SSSI has been listed in Section 9.5.3.

Welsh National Marine Plan (WNMP)

9.2.3.6 The Welsh Government published its first marine plan for Welsh inshore and offshore waters, the Welsh National Marine Plan (WNMP), in November 2019. The WNMP was developed in accordance with the MCAA 2009 and the UK MPS. The WNMP covers a 20-year period from its adoption in 2019. The publishing of the WNMP in November 2019 followed a period of consultation from 7 December 2017 to 29 March 2018. The WNMP is discussed further in Chapter 5: Policy and Legislation.

9.2.3.7 The following key objective of the WNMP is of direct relevance to benthic ecology:

- "*to maintain and enhance the resilience of marine ecosystems and the benefits they provide in order to meet the needs of present and future generations"*

9.2.3.8 Table 9.3 sets out other national WNMP policies which are particularly relevant to benthic ecology.

Table 9.3 - Other National WNMP Policy Provisions Relevant to Benthic Ecology

WNMP Policy Descriptions	Reference	ES Reference
Proposals should demonstrate how they contribute to the protection, restoration and/or enhancement of marine ecosystems.	ENV_01: Resilient marine ecosystems	The Project will put in place mitigation to ensure minimal disturbance to and loss of benthic habitats and species during construction via pre-construction surveys and micro-siting (see Section 9.4.9).
Proposals should demonstrate how they: • avoid adverse impacts on individual Marine Protected Areas (MPAs) and the coherence of the network as a whole; • have regard to the measures to manage MPAs; avoid adverse impacts on non-marine designated sites.	ENV_02: Marine Protected Areas	Consideration of effects on MPAs (Special Area of Conservation) is included within Section 9.6.
Proposals should include biosecurity measures to reduce the risk of introducing and spreading invasive non-native species.	ENV_03: Invasive non-native species	An outline Invasive Non-Native Species Plan has been developed that will be submitted as part of this application (Volume 3, Technical Appendix 9.4: Invasive Non-Native Species Plan).

WNMP Policy Descriptions	Reference	ES Reference
Proposals should demonstrate that they have assessed potential cumulative effects and, in order of preference: a) avoid adverse effects; and/or b) minimise effects where they cannot be avoided; and/or c) mitigate effects where they cannot be minimised. If significant adverse effects cannot be adequately addressed, proposals should present a clear and convincing justification for proceeding. Proposals that contribute to positive cumulative effects are encouraged.	GOV_01: Cumulative effects	Cumulative impacts are assessed in Section 9.10.

9.2.4 Guidance

9.2.4.1 Account has been taken of the following best practice guidelines/guidance:

- Centre for Environment, Fisheries and Aquaculture Science (Cefas) Guidance note for Environmental Impact Assessment in respect of Food and Environment Protection Act (FEPA) and Coast Protection Act (CPA) requirements. Version 2 – June 2004;
- Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects (Judd, 2012);
- Decommissioning of offshore renewable energy installations: guidance notes for industry (BEIS, 2019);
- Guidance to the UK Marine Policy Statement (Defra, 2020b);
- Implementation Guidance on the Welsh National Marine Plan Version 1 (Welsh Government, 2020b); and
- Natural Resources Wales, 2019. GN030 Benthic habitat assessment guidance for marine developments and activities: Guidance for undertaking benthic marine habitat survey and monitoring. Natural Resources Wales, Bangor.

9.3 Consultation and Scoping

9.3.1.1 As part of the EIA process, consultation with key stakeholders has been undertaken at all stages of the Project to date and will continue in the future.

9.3.1.2 An EIA Scoping Report (MarineSpace, 2019) was produced and submitted to NRW in October 2019. NRW consulted with statutory bodies and key stakeholders upon the contents and a formal Scoping Opinion was issued by NRW in January 2020 (NRW, 2020b). Copies of the EIA Scoping Report and NRW's Scoping Opinion are provided in Volume 3, Technical Appendices 2.1 and 2.2, respectively.

9.3.1.3 Following receipt of the EIA Scoping Opinion (NRW, 2020b), NRW's opinion was also sought on the draft survey specification produced for the Project geophysical and environmental surveys (MarineSpace, 2020). Comments were received from NRW in the form of an email and the survey specifications were updated in accordance with NRWs recommendations.

9.3.1.4 Ongoing consultation has taken place with NRW, the Joint Nature Conservation Committee (JNCC) and The Wildlife Trust (TWT) to discuss and agree the suitability of available evidence, assessment methodologies, and forthcoming guidance, where appropriate.

9.3.1.5 Responses and feedback relating to benthic ecology are addressed throughout this chapter. Table 9.4 provides a summary of key points raised and describes how they have been addressed.

Table 9.4 – Summary of Consultation Responses with Statutory Consultees Relating to Benthic Ecology

Consultee	Key Issues Raised	Applicant Action
NRW (Scoping Opinion) January 2020	Scoping Opinion received: • NRW disagree that pollution through accidental spills on benthic habitats should be scoped out; • NRW disagree that effect of EMF on fish and invertebrates scoped out; and • Agree with the scoping in of marine INNS.	Impacts of accidental release of pollutants have been assessed for construction, operation and maintenance , and decommissioning (Section 9.6.2, 9.6.3 and 9.6.4). EMF has been assessed under operation and maintenance (Section 9.6.3 and Volume 3, Technical Appendix 7.2: EMF Assessment. Risk of colonisation of new infrastructure by INNS has been assessed in operation and maintenance (Section 9.6.3 and Volume 3, Technical Appendix 9.4: INNS Plan). All of the above have also been assessed for cumulative impacts (Section 9.10).
NRW March 2020	Receipt of comments regarding the benthic and intertidal geophysical and environmental surveys: • More sample sites preferred over replicates; • Sieve size; • Survey timing; and • Seagrass beds in the intertidal area.	Survey scope updated accordingly in accordance with NRWs requirements.
NRW June 2020 Kick off meeting	Potential impact on benthic habitat as a result of the cable route highlighted.	Noted/acknowledged, impact assessment for construction, operation and maintenance , and decommissioning completed in Sections 9.6.2, 9.6.3 and 9.6.4.
JNCC June 2020 Kick off meeting	Survey specifications had not been sent to the JNCC for consultation, they were therefore sent. No subsequent comments were received.	None.

Consultee	Key Issues Raised	Applicant Action
The Wildlife Trust (TWT) July 2020 Project introduction meeting	Concerns were raised over the cable corridor and the fact that this will be crossing MPAs.	Noted/acknowledged, impact assessment for construction, operation and maintenance , and decommissioning completed in Sections 9.6.2, 9.6.3 and 9.6.4.
NRW January 2021 Export cable route and landfall meeting	Comments raised included: • The need to share the receptor list with NRW for review and comment; and • Introduction of cable protection would create permanent loss where this overlapped with Annex I habitat.	A Technical Note was issued to NRW/JNCC in June 2021, listing the Valued Ecological Receptor (VER) grouping that encompassed biotopes, habitats and features of conservation interest (FOCI) identified and mapped from the desk top and baseline surveys. Assessment of habitat loss has been assessed under Section 9.6.3 for operation and maintenance and also the associated impacts of scouring.
NRW April 2021)	NRW formal response issued in response to Technical Note "Project Erebus FLOW: Initial Assessment of Interaction between Potential Cable Protection and Annex I Habitats within Pembrokeshire Marine SAC" (Version 2.0 – 12 March 2021). Range of comments made in relation to: • Loss of Annex I reef feature and potential Adverse Effect on Site Integrity; • Loss of Annex I sandbanks and potential Adverse Effect on Site Integrity; • Marine and coastal physical processes; • Potential sandwave levelling; and • Use of cable protection.	Meeting was held with NRW in April 2021 to discuss these comments.
NRW/TWT April 2021 Discussion on comments made on the Technical Note	Clarifications included: • It is not possible to assess potential Adverse Effect on Site Integrity (AEoSI) based on the size/area of impact alone. Any assessment must also consider the quality of the feature, including specific reference to the presence, abundance, condition and diversity of typical species; • Certain features that are currently in "unfavourable" status, the implications of any further loss/damage may be	• Ensure any assessment would also consider quality of the feature, not just size/area; • Engaged further with NRW on monitoring reports and status updates for Turbot Bank; • Arranged meeting with NRW to review and discuss draft Coastal

Consultee	Key Issues Raised	Applicant Action
	different to features that are in "favourable" status; and • Interruption to sandbanks that migrate must be assessed at a regional level to provide context for how they link to features within the SAC.	Processes Chapter ahead of submission.
NRW/JNCC June 2021 Erebus Benthic Impact Assessment: version 1.0	Comments included: • Appreciate seeing the full survey report if available; • Agree with approach the applicant has taken to group biotopes. We would suggest in the assessment the applicant also write the full names of the corresponding EUNIS biotopes next to the codes; • Negligible in magnitude assessment is missing; • Unclear where spatial extents have come from. If relating to a protected or sensitive feature, then the extent of impacts should be proportionate to the specific feature. (e.g. *Sabellaria* reef); • We do not agree with defining at this stage a percentage loss of the receptor groups as part of the magnitude of impact definitions; • Amend terms so high magnitude is high frequency and not 'will occur permanently' • Suggests applicant re-defines 'will not adversely affect the status of a conservation feature/ecological functionality' to account for any potential impacts that may cause some permanent changes to the baseline conditions and therefore may potentially adversely affect the status of a conservation feature.	• The subtidal, intertidal and shallow subtidal survey reports are submitted Volume 3, Technical Appendices 9.1, 9.2 and 9.3; • The 'parent' EUNIS names are provided for each VER groups in Table 9.18; • Negligible is included in Table 9.9; • The assessment of magnitude has, where appropriate, been made separately for each VER (or set of VERs), so each impact can be assessed appropriately for receptor in question; • Percentage loss of receptor has been removed from Table 9.9 and all other amendments carried into this table.
NRW/JNCC June 2021 Benthic Impact Assessment Summary Note - Meeting minutes and response (JNCC)	• NRW queried the "potential" sandbank west of Turbot Bank and if is important to understand for the impact assessment if <20m would be classed as a sandbank. • JNCC provided information relating to the definition of Annex I sandbank in relation to features occurring deeper than 20 m in the UK.	• The 'potential' sandbank identified by OEL based on Pinder (2020) outside of the SAC boundary was confirmed by MarineSpace to be in deeper waters. Given its location and depth, it is not considered as an Annex I features.

Consultee	Key Issues Raised	Applicant Action
		• EC (2013) reference has been included in the description of this Annex If feature.

9.4 Assessment Methodology and Significance Criteria

9.4.1 Overview

9.4.1.1 Detailed discussion on the EIA methodology can be found in Chapter 2: Overview of EIA Methodology. Impacts on benthic ecology are based on the impacts identified within the EIA Scoping Report, and any additional potential impacts which have been identified via consultation with key stakeholders.

9.4.1.2 This assessment has been based on the existing baseline environment, as described in Section 9.5 and the PDE as detailed in Chapter 4: Proposed Development Description. Specific parameters that have been the basis of this assessment are provided in Table 9.11.

9.4.1.3 Impacts have been assessed for the following three distinct phases of the proposed project in conjunction with the present-day baseline:

- Construction;
- Operation (and maintenance) (O&M); and
- Decommissioning phase.

9.4.2 Consultation

9.4.2.1 A request for feedback from JNCC/NRW on the *Technical Note, Project Erebus FLOW: Proposed Environment Impact Assessment Methodology for Benthic Ecology (Version 1.0)* was made on 02 June 2021. A formal response was received from JNCC/NRW on 24 June 2021, and this is summarised in Table 9.4 (Section 9.3).

9.4.3 Study Area

9.4.3.1 For the purpose of this chapter, the benthic ecology Study Area covers all areas for placement of Proposed Development including the array area, marine ECC and landfall works (near-field) and areas surrounding the array, ECC and landfall where indirect changes may occur (far-field). Three sub areas have been defined as forming the near-field Study Area:

- Intertidal area at the landfall site, West Angle Bay, between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS) (0.15 km^2);
- Nearshore and offshore ECC route (within the 500 m wide corridor surveyed in 2020) (17.83 km^2); and
- The array area (43.5 km^2) located outside of the 12 nm limit (inclusive of anchor points, mooring lines, WTG and Semi-submersible floating platforms and array cables), plus a 1 km buffer (29.69 km^2).

9.4.3.2 The spatial extent of the far-field part of the Study Area is defined by the tidal ellipses present in this region. Based on information presented in Chapter 6: Marine and Coastal Processes, in mean spring tidal conditions, the approximate tidal excursion distances are:

- 10 km in the array area;
- 14 to 15 km in the middle of the ECC (around KP20); and
- 18 to 19 km nearshore (around KP10).

9.4.3.3 Tidal excursion distance on a mean neap tide is approximately half the corresponding mean spring value.

9.4.3.4 Volume 2, Figure 9.1 shows the Study Area alongside the Project offshore consent boundary. Further details are provided in Chapter 4: Proposed Development Description.

9.4.3.5 The total near-field Study Area is 93.17 km^2 and the overall Study Area, including the far-field zone is 1,319.18 km^2.

9.4.4 Desk Study

9.4.4.1 Information available in publicly available peer reviewed scientific literature and grey literature has been used to characterise the wider marine benthic environment. Stakeholder responses, consultation comments and relevant assessments for nearby development projects (e.g., Greenlink Interconnector) have also been reviewed to inform this assessment.

9.4.4.2 Online websites, directories and data portals have been accessed for spatial information on the presence and potential extent of species, habitats and features of conservation interest in the Study Area, and these include:

- DataMapWales and Lle Geo Data;
- European Marine Observation and Data Network (EMODnet);
- Marine Life Information Network (MarLIN);
- The National Biodiversity Network (NBN) Atlas Wales Portal;
- OneBenthic Data Extraction Tool (Grab/Core); and
- One Benthic Non-Native Species Tool.

9.4.4.3 This information has been used to inform assessment, together with site-specific survey data, as described below.

9.4.5 Baseline Surveys

9.4.5.1 To characterise the benthic ecology of the Study Area and to support the identification of possible features of conservation interest (FOCI), subtidal and intertidal surveys were undertaken capturing benthic ecological data.

9.4.5.2 OEL was commissioned to undertake benthic ecological surveys in Autumn 2020 at the two proposed intertidal landfall sites options at Sawdern Point in Milford Haven Estuary, and West Angle Bay (just within the entrance to Milford Haven Estuary); and the subtidal areas of the ECC and array area (see Volume 3, Technical Appendix 9.2: Environmental Baseline Report and Technical Appendix 9.3: Intertidal Report). In this chapter, only the preferred landfall and associated ECC route option at West Angle Bay will be discussed and assessed, with reference to the Sawdern Point options, where relevant.

9.4.5.3 Additional geophysical surveys were undertaken of the array area in February-April 2021 by GEOxyz, to provide a more completed coverage of the area in which to qualify and update the existing habitat review undertaken by OEL on the earlier 2020 geophysical survey data (see Volume 3, Technical Appendix 9.1: Integrated report (Geophys and Habitat Assessment, Annex 2: Erebus Array Habitat Review)

9.4.5.4 In May 2021, CALM was commissioned to undertake a local, shallow subtidal, survey within West Angle Bay, of an area between the survey boundaries of the intertidal and subtidal surveys that was otherwise unmapped (see Volume 3, Technical Appendix 9.1: Integrated report (Geophys and Habitat Assessment, Annex 1: West Angle Shallow Subtidal Snorkel Survey Report)

9.4.5.5 Table 9.5 provides a summary of the key survey outputs and Volume 2, Figure 9.2 shows the spatial coverage of sampling locations for the subtidal, shallow subtidal and intertidal surveys.

9.4.5.6 These project-specific surveys adhered to the following guidance documents:

- Countryside Council for Wales (CCW) Handbook for Marine Intertidal Phase I Survey and Mapping (Wyn *et al.*, 2006);
- JNCC Guidance on assigning benthic biotopes using EUNIS of the Marine Habitat Classification of Britain and Ireland (Parry, 2019);
- JNCC Marine Monitoring Handbook (Davies *et al*., 2001);
- JNCC Unmanned aerial vehicles for use in marine monitoring (Crabb *et al*., 2019);
- NRW Benthic habitat assessment guidance for marine developments and activities: a guide to characterising and monitoring intertidal rock shore habitats and rock pool habitats (NRW, 2019a); and
- NRW Benthic habitat assessment guidance for marine developments and activities: a guide to characterising and monitoring subtidal sediments (NRW, 2019b).

9.4.5.7 For the subtidal survey, Annex I assessments were undertaken for subtidal reef (rocky and biogenic) and subtidal sandbanks, and the methods for the Annex I assessment undertaken for these surveys, are all described under Section 9.4.6.

9.4.5.8 For full details of the subtidal Environmental Baseline Surveys (EBS), Habitat Assessment (HA) survey designs, geophysical verification of the 2020 assessment, methodology, data analysis and outputs, Volume 3, Technical Appendix 9.2: Environmental Baseline Report and Annex 2: Erebus Array Habitat Review.

9.4.5.9 For the intertidal survey, following classification and mapping of habitats and biotopes, an assessment for the presence of Annex I habitats and Section 7 HPI/OSPAR was carried out. The approach for the assessments undertaken for Annex I features is described under Section 9.4.6. For full details of the intertidal habitat survey design and methodology, refer to Volume 3, Technical Appendix 9.3: Intertidal Report.

9.4.5.10 With respect to the additional shallow sub-tidal survey (undertaken in May 2021), on completion of the survey, habitat and species information was ascribed Marine Nature Conservation Review (MNCR) biotope codes (JNCC, 2015a); and assessment was made on the presence of rocky Annex I reef and other habitats or species of know conservation importance. The methods for the Annex I assessment undertaken for these surveys, are all described under Section 9.4.6. For full details of the shallow subtidal habitat survey design and methodology, refer to Volume 3, Technical Appendix 9.1: Integrated report (Geophys and Habitat Assessment), Annex I: West Angle Shallow Subtidal Snorkel Survey Report.

Table 9.5 – Summary of Site-specific Ecological Surveys Undertaken to Characterise the Baseline for Benthic Ecology.

Survey Type	Dates	Methods	Key Outputs
Intertidal Habitat	**Autumn 2020** 16.10.2020 - 17.10.2020	**Phase I** Unmanned Aerial Vehicle (UAV) and walkovers **Phase II** 0.25 m^2 quadrat assessments and 0.01 m^2 core sampling - Community and habitat data; - European Union Nature Information System (EUNIS) ascriptions; - FOCI assessments; - Habitat/biotope mapping.	- 318 UAV images - 86 target notes sites - 58 quadrats - 28 sediment cores.
Shallow Subtidal Habitats	**Spring 2021** 14.05.2021	**Free-diving (snorkel) survey** - Habitat and species data; - Sediment depths (if any); - MNCR biotope ascriptions; - FOCI assessments.	- 21 locations
Subtidal Habitats	**Autumn 2020** *Nearshore* 21.10.2020 - 11.11.2020 *Offshore* 09.11.2020 – 29.11.2020	**EBS** Drop Down Video (DDV) and Drop Down Camera (DDC) imagery, 0.1 m^2 grabs (Day/DVV/ mini-Hamon) **HA** DDV and DDC - Macrobenthic community assessments; - Physicochemical sediment analysis; - Broadscale Habitat (BSH); - EUNIS ascriptions; - Habitat/biotope mapping; - FOCI assessments.	**ECC** - 56 EBS DDC - 50 EBS Grabs - 58 HA Transects **Array Area** - 15 EBS DDC - 57 EBS Grabs - 47 EBS / HA Transects

9.4.6 Annex I Assessment

9.4.6.1 Following the surveys, relevant Annex I assessment was undertaken on those features that had the potential to be deemed Annex I. Assessments considered the following relevant guidelines and their associated criteria:

- JNCC The identification of the main characteristics of stony reef habitats under the Habitats Directive. Summary report of an inter-agency workshop (Irving, 2009);
- JNCC Refining the criteria for defining areas with a 'low resemblance' to Annex I stony reef (Golding *et al*., 2020);
- JNCC Defining and managing *Sabellaria spinulosa* reefs. Report of an inter-agency workshop (Gubbay *et al*., 2007);
- JNCC Common Standards Monitoring Guidance for Sea Caves (JNCC, 2004);

- JNCC Annex I Sandbanks in the UK version 3 – 2019 (Public) Polygons (JNCC, 2019); and
- JNCC Method for Creating Version 3 of the UK Composite Map of Annex I Sandbanks slightly covered by seawater all the time (Pinder, 2020).

Annex I Reefs – Rocky

9.4.6.2 Rocky reefs are marine habitats that rise from the seabed. There is a wide variety of topographical forms of Annex I Reef, ranging from vertical rock walls to horizontal ledges, sloping or flat bedrock (bedrock reef) to broken rock, boulder fields and aggregations of cobbles (stony reef) (JNCC, 2021b).

9.4.6.3 All geophysical and ground truthing data were reviewed to assess for the presence and potential extent of Annex I reef, with a full assessment for the presence of rocky reef, following Irving (2009), was undertaken on the imagery in (Bio-Image Indexing and Graphical Labelling Environment (BIIGLE), to determine whether habitats met the criteria of Annex I stony reef (Table 9.6). There are currently no guidelines for determining the quality ('reefiness') of bedrock reef habitats, however some of the criteria listed in Table 9.6 can be adapted to also assess for this feature (e.g. composition and extent). Consideration was also given to the assessment of any 'low resemblance' reef following Golding *et al.* (2020).

9.4.6.4 For Annex I rocky reef to be classified as present within the intertidal zone, they will form a continuous feature and thus, be connected to subtidal reef(s) (JNCC, 2021b; EC, 2013). As such, it was important that any observations and assessments made across the rocky features of the intertidal zone on West Angle Bay were also cross-referenced to those made from the subtidal surveys in West Angle Bay; and to the later, shallower subtidal snorkelling surveys undertaken at this site; that linked these two survey areas.

Annex I Reefs – Biogenic

9.4.6.5 Biogenic reefs are biological concretions created by animals that rise from the seabed; and are less variable than rocky reef (JNCC, 2021b). A full assessment for the presence of subtidal Annex I biogenic *Sabellaria spinulosa* (Ross worm) reef was undertaken on the imagery in BIIGLE to determine whether habitats met the criteria of a *S. spinulosa* reef following Gubbay (2007); Table 9.7.

Table 9.6 – Criteria for Assessment of Stony Reef (Irving, 2009).

Characteristic	'Reefiness'			
	Not a Reef	**Low**	**Medium**	**High**
Composition*	<10%	10-40% matrix supported	40-95%	>95% clast supported
Elevation	Flat seabed	<64 mm	64 mm – 5 m	>5 m
Extent	<25 m^2	>25 m^2		
Biota	Dominated by infaunal species	>80% of species present composed of epibiota species		
*Proportion of boulders/cobbles > 64 mm or bedrock.				

Table 9.7 – Characteristics of *Sabellaria spinulosa* reef (after Gubbay, 2007).

Characteristic	'Reefiness'			
	Not a Reef	**Low**	**Medium**	**High**
Elevation (cm)	<2	2-5	5 - 10	>10
Extent (m^2)	<25	25 – 10,000	10,000 - 1,000,000	>1,000,000
Patchiness (% Cover)	<10	10-20	20-30	> 30

Annex I Sandbanks which are slightly covered by seawater all of the time

9.4.6.6 Sandbanks are described as distinct banks; topographic features that can be elongated, rounded or irregular mounds. They are permanently submerged and predominantly surrounded by deeper water and consist of sandy sediments that are permanently covered by shallow seawater. They are located typically at depths of less than 20 m, however, can extend beneath this depth, and thus, it is appropriate to include in designations such areas where they are part of the feature and host its biological assemblages (EC, 2013) Sandbanks can be categorised into four main types: gravelly and clean sands; muddy sands; eelgrass *Zostera marina* beds; and maërl beds (JNCC, 2021c;).

9.4.6.7 All geophysical and ground truthing data were reviewed to assess for the presence and potential extent of Annex I subtidal sandbanks. Potential subtidal sandbanks were assessed following criteria set out in Pinder (2020), which outlines the three descriptors characterising this feature:

- Topography: elongated, rounded or irregular 'mound' shapes which may arise from horizontal or sloping planes of sandy sediment at depths of less than 20 m;
- Substrate/vegetation: mainly composed of sand (≥50%) and may support *Zostera marina* or maërl beds; and
- Proximity to known sandbanks/similarity in benthic community: Areas of horizontal or sloping sandy habitats are closely associated with known sandbanks.

9.4.6.8 Topographical features were determined by interpretation of the geophysical data, while ground-truthing data were used to assess sediment type and composition, and presence of key flora and fauna. Areas that met all of the above criteria were delineated and assigned confidence score of 'High', and 'Potential' assigned to areas meeting only some of the criteria and not including proximity to known sandbanks.

Annex I Mudflats and sandflats not covered by seawater at low tide

9.4.6.9 Intertidal mudflats and sandflats are submerged at high tide and exposed at low tide and form a major component of H1130 Estuaries and H1160 Large shallow inlets and bays. Three broad categories can comprise this habitat type: clean sands; muddy sands; and mud (JNCC, 2021d). Field observations and biotopes ascribed at West Angle were sampled to determine the presence and/or extent of this feature at the landfall site.

Annex I Submerged or partially submerged sea caves

9.4.6.10 Submerged or partially submerged sea caves (hereafter called sea caves) can vary in size, from only a few metres to extensive systems, and are typically associated with H1170 Reefs. Formations will vary from tunnels or caverns and with vertical and overhanging rocks providing marine habitats (JNCC, 2021e).

9.4.6.11 There are no established criteria for the assessment of quality of Annex I sea caves, however several characteristics are to be considered when assessing the condition of this feature (JNCC, 2004), and these include:

- Extent;
- Number in site;
- Biotope composition;
- Presence of representative/notable biotopes and their species composition; and
- Presence and/or abundance of specified species.

9.4.6.12 Field observations and biotopes ascribed at West Angle were exampled to determine the presence and/or extent of this feature at the landfall site.

9.4.7 Valued Ecological Receptors

9.4.7.1 The value of ecological features is dependent upon their biodiversity, social and economic value within a geographic framework of appropriate reference (CIEEM, 2016). Identifying those habitats and species that have a specific biodiversity value recognised through international or national legislation, or through local, regional or national conservation plans (e.g. Annex I habitats and Section 7, existing and recommended Marine Conservation Zones) is understood to be the most straightforward context for assessing ecological value. Under the existing legislative or policy framework, a very small proportion of marine habitats and species are afforded protection and, therefore, evaluation must also assess value according to the functional role of the habitat or species. For example, some features may not have a specific conservation value in themselves but may be functionally linked to a feature of high conservation value.

9.4.7.2 A high number (>50) of EUNIS habitats//biotopes were identified from the baseline surveys. For the purpose of this EIA, habitats identified and mapped from the baseline surveys with similar physical characteristics, biological characteristics, and, where appropriate, conservation status/interest (Annex I, Section 7, and OSPAR) have been grouped together.

9.4.7.3 The sensitivities of these different habitats were also considered, such that habitats and species with similar vulnerability and recoverability were grouped together. Sensitivities to help inform groupings were based on the Marine Evidence based Sensitivity Assessment (MarESA), as detailed on the MarLIN website.

9.4.7.4 This approach avoided the requirement to assess the potential effects of the Project on each individual biotope but assess against broad "receptor groups" (Valued Ecological Receptors). The Valued Ecological Receptor groupings, and their descriptions, are listed in Table 9.18 and Section 9.5.8, and represent the intertidal and subtidal rock and sedimentary benthic environment of the Study Area.

9.4.7.5 This approach was agreed via written response from NRW/JNCC dated 24 June 2021, which included a request that the full names of the corresponding EUNIS biotopes were listed in the assessment next to the VER codes.

9.4.8 Assessment of Potential Effect Significance

9.4.8.1 Determination of whether predicted effects are likely to be significant is made by relating receptor sensitivity to magnitude of environmental effects.

Sensitivity

9.4.8.2 The overall receptor sensitivity is determined through consideration of the receptor's:

- Tolerance to an impact (the extent to which the receptor is adversely affected by an impact);
- Adaptability (the ability of the receptor to avoid adverse effect that would otherwise arise from an impact); and
- Recoverability (a measure of a receptor's ability to return to a state at, or close to, that which existed before the impact caused a change).

9.4.8.3 In addition, a value component may also be considered when assessing a receptor. This ascribes whether the receptor is rare, protected, or threatened.

9.4.8.4 Table 9.8 sets out the criteria used in defining the sensitivity of benthic ecology receptors.

Table 9.8 – Sensitivity Levels for Receptors (benthic ecology)

Sensitivity	Description	Value
High	Receptor has very limited capacity to avoid, adapt to, accommodate, or recover from the anticipated impact.	Receptor is designated under national or international legislation (e.g. Annex I habitat under Conservation of Habitats and Species Regulations 2017 (as amended)).
Medium	Receptor has limited capacity to avoid, adapt to, accommodate, or recover from the anticipated impact.	Receptor is not listed as a qualifying feature of a designated site (SAC) but is a supporting component of the qualifying features. Not Annex I habitat but listed as a Priority Habitat under Section 7 of the Wales (Environment) Act 2016.

Sensitivity	Description	Value
Low	Receptor has some tolerance to avoid, adapt to, accommodate, or recover from the anticipated impact.	Receptor is not designated and/or protected but is deemed to be a key part of the wider marine ecosystem.
Negligible	Receptor is generally tolerant to and can accommodate, or recover from the anticipated impact.	Receptor is not designated and/or protected and is deemed to be of limited importance for the wider marine ecosystem.

Magnitude

9.4.8.5 Assessment of impact magnitude is based on the expected effects on specific benthic ecology receptors from Project activities. The magnitude of an impact is dependent on its:

- Scale (e.g. size, extent or intensity);
- Duration;
- Frequency of occurrence; and
- Reversibility (i.e. the capacity of the environment to return to a condition equivalent to the baseline after the impact ceases).

9.4.8.6 Potential impacts are described in terms of persistence (permanent or temporary) and effect type (adverse or beneficial). Magnitude of impact is based on a variety of parameters including duration, timing, size and scale, and frequency of occurrence.

9.4.8.7 Table 9.9 sets out the criteria used in defining the magnitude of benthic ecology receptors. Definitions in this table may not be appropriate for all impacts; for example, there may be an impact which is over a very small area (minor or moderate) but is repeated a large number of times during a particular phase of the project (major or severe). In such cases expert judgement is used to determine the most appropriate magnitude ranking and this is explained through the narrative of the assessment.

Table 9.9 – Magnitude Levels for Receptors (benthic ecology)

Magnitude	Description
High	The impact: - is widespread across a large area; - will result in the loss of all of the receptor group; - will occur for a prolonged period of time (>5 years); - will occur at a high frequency; - will result in extensive temporary or permanent changes to the baseline conditions; and, - will adversely affect the status of a conservation feature/ecological functionality.
Medium	The impact: - will occur over a large spatial extent; - will result in loss of the majority of the receptor group;

Magnitude	Description
	- will occur for a long period of time (1-5 years); - will occur at a medium-high frequency; and, - will result in extensive temporary changes and some permanent changes to the baseline conditions; - will result in some changes to a conservation feature/ecological functionality, but not will adversely change the overall status of a conservation feature/ecological functionality.
Low	The impact: - is localised (immediate locality, or within the project footprint); - will potentially result in some loss of a minor part of the receptor group; - will occur for a short period of time (<1 year); - will occur at a medium frequency; - will result in temporary changes or limited permanent changes to the baseline conditions; and, - will not adversely affect the status of a conservation feature/ecological functionality.
Negligible	The impact: - is extremely localised; - will result in a small loss of the receptor group; - will occur for a very short period of time (< 1 week); - will occur once or highly infrequently; - will result in very limited, reversible change to baseline conditions; and, - will not adversely affect the status of a conservation feature/ecological functionality.

Significance of Effect

9.4.8.8 Following the identification of a benthic receptor's sensitivity and value, and magnitude of effect, the significance of the effect is determined by correlating the magnitude of the impact and the sensitivity of the receptor (Table 9.10). On this basis, potential effects are assessed as of negligible, minor, moderate and major significance (definitions are provided in Chapter 2: Overview of EIA Methodology).

9.4.8.9 For the purposes of this assessment, any effects with a significance level of:

- Major: significant in EIA terms;
- Moderate: significant in EIA terms;
- Minor or negligible: non-significant in EIA terms; and
- Negligible: non-significant in EIA terms.

Table 9.10 – Effect Significance Matrix

		Sensitivity			
		High	**Medium**	**Low**	**Negligible**
Magnitude	**High**	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Minor
	Low	Moderate	Minor	Minor	Negligible
	Negligible	Minor	Minor	Negligible	Negligible

9.4.8.10 Within the context of benthic ecology, the terms used in Table 9.10 to describe the predicted level of effect are defined as:

- Major beneficial or adverse effect – where the Proposed Development would result in a very large or large change in receptor condition, both adverse or beneficial, which is likely to be an important consideration at a regional or district level because the receptor contributes to achieving national, regional or local objectives, or, could result in exceedance of statutory objectives and/or breaches of legislation.
- Moderate beneficial or adverse effect – where the Proposed Development would result in an intermediate change in receptor condition, which is likely to be an important consideration at a local level;
- Minor beneficial or adverse effect – where the Proposed Development would result in a small change in receptor condition, which may be raised as a local issue but is unlikely to be important in the decision-making process; and
- Negligible – where the Proposed Development would result in no discernible improvement (or deterioration) in receptor condition.

9.4.9 Standard Mitigation

9.4.9.1 A range of standard mitigation measures has already been applied to the Project as part of the over-arching site selection and iterative design process (see below and Chapter 3: Site Selection and Alternatives). These have been introduced in order to minimise potential impacts of the Project on any sensitive receptors.

9.4.9.2 Standard mitigation measures which the Project has already implemented, or is committed to in the future, in order to minimise potential impacts on benthic ecology are listed below.

- Initial site selection (array) area avoided sensitive habitats including SAC/Annex I;
- Detailed pre-consent cable route refinement designed to avoid sensitive habitats including SAC/Annex I;
- Horizontal Directional Drill (HDD) proposed at landfall, open cut trenching only included as contingency;
- Anchors proposed for FLOW mooring, piling/drilling to only be used where sediment not thick enough to anchor;
- Amount of potential cable protection minimised via detailed route refinement and burial risk assessment studies;

- Use of standard operating procedures and equipment for activities disturbing sediment, e.g. installation of anchors, cable burial, dredging, sandwave levelling, trenching works nearshore, HDD;
- Cable burial design plan to minimise and mitigate the need for cable protection and to reduce the risk of future cable exposure requiring additional maintenance work or cable protection;
- Invasive Non-Native Species (INNS) Plan being developed as part of the Project (Volume 3, Technical Appendix 9.4: Invasive Non-Native Species Plan);
- Marine Biodiversity Enhancement Strategy to be developed to account for any loss of key habitats;
- Production of a Project Environmental Management Plan (PEMP) to include details on marine pollution contingency plans. This document will also include details of all chemicals proposed to be used, ensuring that those chemicals are approved under the Offshore Chemical Regulations 2002;
- Best practice techniques employed throughout all construction, O&M and decommissioning activities. Construction practices will comply with a Construction Environmental Management Plan (CEMP), to ensure appropriate Pollution Prevention Guidelines (PPG) and good practice guidelines are followed; and
- It is anticipated an Environmental Mitigation and Monitoring Plan (EMMP) will be produced prior to construction. This would include the mitigation measures embedded into the design.

9.4.10 Additional Mitigation and Assessment for Residual Effect Significance

9.4.10.1 The impact assessments and conclusions on significance of effect presented in Section 9.6 assume that these standard mitigation measures listed above have been successfully implemented. Where significant environmental effects remain, even after these standard measures have been factored in, then project-specific mitigation measures are detailed and the residual significance of effect presented.

9.4.11 Limitations to Assessment

9.4.11.1 It is acknowledged that changes to the existing benthic ecology baseline could occur as a result of environmental changes that can act both seasonally (mild winters; storm events) and over the long term (climatic changes; change in land/sea use). These can cause changes in the local and wider benthic community such as poor recruitment periods and subsequent population crashes; spread of southern species (e.g., Lusitanian) and INNS species, and localised changes in sediment distributions.

9.4.11.2 While every effort has been made to ensure a wide range of literature has been used throughout this assessment, the data used to produce this literature will only provide a representation of benthic ecology as it was, at the time of collection.

9.5 Baseline Conditions

9.5.1 Overview

9.5.1.1 To characterise the existing environment within the Study Area, and so to inform the assessment, a combined understanding is required of current benthic ecology and physical environmental conditions across the regional and the Study Area, determined from the desk-based reviews and key findings of the three project specific surveys and assessments . Section 9.5 is structured through the following sub-sections:

- 9.5.2: Regional overview of the environment and broadscale predicted habitats;
- 9.5.3: Regional nature conservation data on the known and predicted extent of statutory designated features and INNS;
- 9.5.4: Physical environment of the Study Area;
- 9.5.5: Biological environment of the Study Area;
- 9.5.6: Biotope classifications of the Study Area;
- 9.5.7: Distribution of FOCI within the Study Area;
- 9.5.8: VER groupings; and
- 9.5.9: Data gaps and uncertainties for consideration.

9.5.2 Regional Environment

9.5.2.1 The waters off Pembrokeshire support a diverse range of intertidal and subtidal habitats. Predicted MSFD benthic broad types shown in Volume 2, Figure 9.3 show a clear demarcation in habitat complexity from the nearshore to offshore areas. Across the offshore region, there is a large expanse of offshore circalittoral sand. To the west of this, and with discrete patches near the western arm of the ECC, are also areas of offshore circalittoral mud. Moving towards the adjacent coastline, the sediments become less uniform and are generally coarser, represented by large bands of both offshore circalittoral coarse and circalittoral coarse sediment and circalittoral sand. Within the inshore coastal areas, circalittoral rock and biogenic reef, and areas of infralittoral coarse sediment are mapped.

9.5.2.2 Further EMODnet mapping reports on the predicted distribution of broad EUNIS biotope complexes. The dominant sedimentary EUNIS biotopes include:

- A5.44 Circalittoral mixed sediments;
- A5.25 Circalittoral fine sands; and
- A5.15 Deep circalittoral coarse sediment.

9.5.2.3 Moving inshore, these offshore and circalittoral sediment transition into rocky habitats. Around the entrance to Milford Haven, and fringing the coastline, rocky habitats are represented by the following key biotope complexes:

- A4.214 Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock;
- A3.21 Kelp and red seaweeds (moderate energy infralittoral rock); and
- A3.11 Kelp with cushion fauna and/or foliose red seaweeds.

9.5.2.4 Across the intertidal areas, existing intertidal EMODnet mapping predicts that habitats outside of Milford Haven primarily consist of intertidal sandy shores with moderate to high energy intertidal rock. Intertidal biogenic habitats, such as seagrass beds and saltmarshes, are also present, but in more sheltered locations within Milford Haven.

9.5.2.5 Some of these habitats of the region will contain features representative of nature conservation designations, such as Annex I of the EC Habitats Directive, OSPAR List of Threatened and/or Declining Species and Habitats, and HPI Section 7 of the Environment (Wales) Act (2016). The expected spatial distribution of designated features across the region and potential overlap with the Study Area is described in sub-Section 9.5.3 below.

9.5.3 Regional Nature Conservation Features

Overview

9.5.3.1 There are several domestic and international statutory designated sites, that receive designation under various nature conservation legislation, which overlap with the Study Area. For a detailed description of all nature conservation sites see Chapter 8: Offshore Designated Sites.

9.5.3.2 Not all sites listed will be required to be considered in this assessment for benthic ecology. For consideration of international sites, assessment will include the Sir Benfro Forol/Pembrokeshire Marine SAC only, as it contains benthic features and directly overlaps the Study Area.

9.5.3.3 The Arfordi Calchfaen de Orllewin Cymru/Limestone Coast of South West Wales SAC contains Annex I benthic features; however, as it is located approximately 4 km from the ECC and landfall at West Angle, it is unlikely that any potential effects from Project activities will interact with these features. The Gorllewin Cymru Forol/West Wales Marine SAC overlaps with the Study Area however, is designated for an Annex II marine mammal species (harbour porpoise) and is considered in Chapter 12: Marine Mammals, and in the relevant assessments as part of Volume 3, Technical Appendix 8.3: Report to Inform Appropriate Assessment.

Arfordir Penryn Angle/Angle Peninsula Coast SSSI

9.5.3.4 The domestic site, Arfordir Penryn Angle/Angle Peninsular Coast Site of Special Scientific Interest (SSSI) lies within the Sir Benfro Forol/Pembrokeshire Marine SAC, covers an area of 1.34 km^2, and directly overlaps the Study Area at the landfall of West Angle Bay by approximately 0.15 km^2 (CCW, 2006).

9.5.3.5 The benthic special interest features of the SSSI include its: geology; wide range of intertidal rock, sand and gravel habitats and communities, particularly rock pools, caves and overhangs; tide-swept algae and under boulder communities.

Sir Benfro Forol/Pembrokeshire Marine SAC

9.5.3.6 The Sir Benfro Forol/Pembrokeshire Marine SAC (hereafter referred to as the SAC), encompasses an extremely wide range, distribution, and extent of marine habitats of sea inlets, tidal rivers, estuaries, mud flats, sand flats, lagoons, salt marshes, salt pastures and salt steppes. The site overall covers an extent of 1,380 km^2 (NRW, 2018; JNCC, 2021f).

9.5.3.7 The site overlaps with the landfall at West Angle Bay and partially with the ECC and is located approximately 16.5 km from the array area. The SAC is a multiple interest site that has been selected for the presence of 8 marine habitat types and associated wildlife (Habitats Directive Annex I) and 7 Annex II species (Habitats Directive Annex II species). The relevant designated marine and coastal features (benthic) of the site are listed below:

- Annex I habitats that are a primary reason or selection of this site:
  - H1130 Estuaries;
  - H1160 Large shallow inlets and bays; and
  - H1170 Reefs.
- Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site:
  - H1110 Sandbanks which are slightly covered by sea water all the time;
  - H1140 Mudflats and sandflats not covered by seawater at low tide;
  - H1150 Coastal lagoons;
  - H1330 Atlantic sea meadows (*Glauco-Puccinellietalia maritimae)*; and
  - H8330 Submerged or partially submerged sea caves.
- Annex II benthic species that are a primary reason for site selection:
  - S1441 Shore dock *Rumex rupestris.*

FOCI: Habitats Directive Annex I

9.5.3.8 The indicative distribution of Annex I habitats within the SAC is shown in Volume 2, Figure 9.4 a-b with features overlapping in some locations. As expected, no designated Annex I habitats are recorded within the array area or the majority of the ECC, as these areas lie outside of the boundary of the SAC.

9.5.3.9 However, it will be important to consider that such FOCI such as reefs, may be present outside the limit of this designated site, and in Volume 2, Figure 9.4a, Article 17 reporting shows this wider extent of reefs and sandbank features, outside the site boundaries.

9.5.3.10 Moving inshore, the offshore consent boundary overlaps with an expansive area of (rocky) reef and intersects a sandbank. Reef features continue to extend into West Angle Bay and at the landfall, where intertidal mudflats and sandflats (19 km^2) are also present. An almost continuous extent of sea caves (255 km length) is predicted to border the coast (Volume 2, Figure 9.4a). The approach to, and landfall at, West Angle Bay, sits within the estuary and large shallow inlet and bay features of the Milford Haven waterway. Atlantic salt meadows and coastal lagoons are also present within the waterway but are outside of the ECC and landfall site (Volume 2, Figure 9.4b).

9.5.3.11 Rocky reefs in the southwest Wales region are mainly composed of igneous rock and also include more friable Old Red Sandstone and limestone and are distributed throughout the SAC with much of the intertidal zone as rocky reef habitat and extensive subtidal areas also. The total area of Annex I intertidal reef (within the SAC) is 11.5 km^2 (Lle Geo-Data Portal, 2021) but this is narrow due to the high proportion of steeply sloping shores. The extent of exposed reefs will vary due to sediment movement across these substrates; the extent of subtidal reef is large not known precisely.

9.5.3.12 At present it is understood that the total area of subtidal rocky reef is 433.2 km^2 (Lle Geo-Data Portal, 2021). Under Article 17 reporting, the subtidal reef feature extends outside of the boundary of the SAC by a further 63.15 km^2, identified as possible reef feature, around, and within the Study Area (Volume 2, Figure 9.4a) (Lle Geo-Data Portal, 2021). Within the SAC, bedrock reef is overall more extensive than stony reef (Greenlink, 2019). Highly variable rocky topography, indented coastline and strong tidal streams in the shallow southwest facing rocky reefs are exposed to extreme wave action, compared to extremely wave sheltered sites within the region. This wide variation in reef form and environmental conditions means that a range of communities are supported across these features (JNCC, 2021b; NRW, 2018a).

9.5.3.13 Long term, time series monitoring of subtidal rocky reef assemblages (e.g. epifaunal sponges, corals and pink sea fans) in the Skomer Marine Conservation Zone (MCZ) in the SAC (located outside of the Study Area), indicate that the communities are complex and rich, but with species assemblages exhibiting intermittent reproductive success and irregular recruitment, which in part can be dependent on recruitment from outside the site (Burton *et al.,* 2020; NRW, 2018a). Monitoring of intertidal rocky reef communities at sites within the SAC, Milford Haven waterway (2005-2014) reported temporal fluxes in species abundances, but with spatial differences primarily attributed to the different shore types (Bunker, 2015).

9.5.3.14 There are several major sandbanks within the SAC, including Turbot Bank (19.1 km^2) that the ECC partly overlaps; St Gowan Shoals, (16.05 km^2) to the east of Turbot Bank; and The Knoll (5.09 km^2) and Wild Goose Race sandbanks in the vicinity of Skokholm. These sandbanks likely belong to the subtype gravelly and clean sands and in total are predicted to cover an area of approximately 51.6 km^2, with an extension of these outside the SAC boundary by 28.8 km^2, of which Turbot Bank extends out by 4.95 km^2 (as reported under Article 17) (Volume 2, Figure 9.4a) (Lle Geo-Data Portal, 2021).

9.5.3.15 Turbot Bank is a sink for glacial till and land-derived sediments from the Cleddau Ddu and Milford Haven Estuary, that are reworked by strong tidal currents (Greenlink, 2019). Recent sampling across Turbot Bank along the western area (Greenlink, 2019) recorded fine sandy sediments, supporting an assemblage, characterised by bivalve molluscs *Goodallia triangularis*, *Abra prismatica*, *Kurtiella bidentata*, *Timoclea ovata* and polychaetes *Nephtys cirrosa* (cat worms) and *Ophelia borealis*.

9.5.3.16 The NRW (previously CCW) Bays and Banks surveys at Turbot Bank (2008 and 2013; n = 12 sites sampled each year) on the eastern area, reported similar assemblages overall to the 2019 sampled community, predominantly comprising small cumacean and amphipod crustaceans; bivalve molluscs *Abra* spp. and *Spisula* sp.; and the polychaetes *Nephtyidae* (catworms), *Glyceridae* (bloodworms), and *Opheliidae* (NRW. 2021a). For the comparisons between the 2008 and 2013 monitoring years, there was an overall increase in average sample abundances, and overall richness, and the communities shifted from one characterised by small cumacean crustaceans and predatory polychaetes (e.g. *Nephtys* sp. and *Glycera* sp.*)* to a more mixed assemblages with a dominance of bivalves (*Spisula* sp.*)* (however this is only based on comparison between two datasets).

9.5.3.17 The extent of mudflats and sandflats not covered by seawater at low tide is approximately 19 km^2 within the SAC (Lle Geo-Data Portal, 2021).

9.5.3.18 The latest indicative site condition assessment for Annex I features within the SAC has reported all Annex I habitats to be in an ‘unfavourable’ condition overall, with the exception of sea caves, where their status is currently ‘unknown’ (NRW, 2018b).

9.5.3.19 At a European context, the JNCC (2021e) has assigned sea caves in the region as Grade B which equates to *'Examples of features which are of at least national importance but not significantly above this. These features are not the primary reason for SACs being selected.'*

9.5.3.20 Table 9.11 lists the breakdown of each individual criteria assessed by NRW (2018b) for the Annex I benthic features that are likely to overlap the Study Area. On examination of each individual component, each feature was assessed as 'favourable' for distribution and extent. Also, to note, that for both reefs and Atlantic salt meadows, the overall confidence in these assessments was Medium, and for subtidal sandbanks the confidence was Low. This low confidence assessment for subtidal sandbanks against criteria 'Typical Species' made at the time of the assessment was assigned due to age of macrofaunal sample data and uncertainty to the cause of change.

Table 9.11 - Indicative Assessment of Benthic Annex I Features by Individual Components (NRW, 2018b)

Criteria	Reefs	Subtidal sandbanks	Intertidal mudflats and sandflats	Sea caves
Range (distribution and extent)	Favourable	Favourable	Favourable	Favourable
Structure and Function (geology, sedimentology, water and sediment chemistry etc.)	Unfavourable	Favourable	Unfavourable	Unknown
Typical Species (species richness/evenness, population dynamics and range	Favourable	Unfavourable	Unfavourable	Unknown

9.5.3.21 Records of the reef building worms *Sabellaria spinulosa* and *Sabellaria alveolata* are reported, respectively, across the nearshore subtidal, and intertidal region in Pembrokeshire (NBN, 2021). However, no Annex I biogenic *S. spinulosa* (also OSPAR), or *S. alveolata* reefs (also Section 7), is reported or predicted to be present within the SAC. It is thought that the extent of *S. spinulosa* reefs is potentially underestimated (NRW, 2019b), whilst the extent and distribution of *S. alveolata* reefs is thought to be increasing in Wales (Mercer, 2016). Recent survey assessments by Greenlink (2019), identified a number of potential, low, and medium quality biogenic *S. spinulosa* reefs, approximately 42 km from shore, and the majority of these were identified to be A5.611 *'Sabellaria spinulosa* on stable circalittoral mixed sediments.'

9.5.3.22 The presence, local extent, and potential quality of Annex I features across the Study Area has been assessed further through the Project specific baseline surveys.

FOCI: Environment (Wales) Act 2016 Section 7 and OSPAR habitats and species

9.5.3.23 The distribution of Section 7 Habitats of Principal Importance (Environment (Wales) Act, 2016) and OSPAR threatened and declining habitats across the region is presented in Volume 2, Figure 9.5.

9.5.3.24 Across the offshore ECC and array area there are no Section 7 or OSPAR habitats shown to be present. However, Section 7 Subtidal Sands and Gravels (data layer not available from Lle Geo-Portal (2021)) may be expected to be present across the region, as there are large areas of the BSH circalittoral sand present, and this feature is mainly associated with sandy sediments (though with combination of gravels also). This also corresponds with Annex I Sandbanks and Estuaries that are designated SAC features in the region (JNCC, 2008).

9.5.3.25 Towards the nearshore region, extensive areas of subtidal mixed muddy sediments are shown to be present, partly overlapping the ECC in these areas. Point records of fragile sponge and anthozoan communities border the Pembrokeshire nearshore, and across the entrance to Milford Haven, and so may interact with the ECC. Intertidal underboulder communities are present along the coast and, notably, within Milford Haven and, although not shown, are expected to be present at the landfall at West Angle Bay.

9.5.3.26 Within Milford Haven's more sheltered areas, mudflats and sheltered muddy gravels are present. Within the tributaries and upstream areas, estuarine rock, saltmarshes and saline lagoons are also supported. Discrete areas of biogenic habitats of blue mussel beds within Pennar Gut, and living and dead coralline maërl in the channel of the waterbody are also reported to be present.

9.5.3.27 Section 7/OSPAR habitat *Ostrea edulis* (native oyster) beds are not reported in the region. However, individuals of the species, also designated under Section 7 and OSPAR, have been recorded as present along the nearshore regions of Pembrokeshire (NBN, 2021). Currently research projects are looking at the feasibility to restore populations in the upper reaches of Milford Haven (NRW, 2021a). Records of other Section 7 or OSPAR benthic species recorded in the region (NBN, 2021) are summarised below:

- *Arctica islandica* (ocean quahog): Pembrokeshire nearshore areas and Milford Haven;
- *Atrina fragilis* (fan mussel): single records in Milford Haven and off Saundersfoot;
- *Eunicella verrucosa* (pink sea-fan); Milford Haven entrance, Skomer and north Pembrokeshire coast;
- *Lithothamnion corallioides* (coral maërl) and *Phymatolithon calcaereum* (common maërl): Few records, predominantly from Milford Haven (see also Volume 2, Figure 9.5 for the bed extent);
- *Nucella lapillus** (dog whelk) (*pending recommendation): cosmopolitan distribution around Pembrokeshire coast and Milford Haven; and
- *Padina pavonica* (Peacock's tail): single record at Pembroke Dock, Milford Haven.

FOCI: Invasive Non-Native Species

9.5.3.28 INNS species are species that have been introduced, either intentionally or unintentionally, to areas outside of their natural geographical range. The introduction and/or spread of some non-native species can potentially threaten biological diversity or have other unforeseen impacts. Wales has commitments under the GB Invasive Non-Native Species Strategy to take action to prevent, detect, eradicate and manage INNS (NBN, 2021).

9.5.3.29 INNS are expected to be present in the region, and notably within the busy shipping lane and port of Milford Haven. INNS recorded in the Study Area are presented in Section 9.5.7.32 and for further details on list of benthic species present in the region, refer to Volume 3, Technical Appendix 9.4: Invasive Non-Native Species Plan.

9.5.4 Physical Environment

9.5.4.1 Table 9.12 provides an overview of the physical characteristics of the Study Area. Whilst a detailed description is provided in Chapter 6: Marine and Coastal Processes, it is important to have an understanding of the broad physical environment due to the link between physical environment and marine ecological features.

Table 9.12 – Overview of physical environment

Parameter	Description
Bathymetry	Water depths across the Study Area range from 85 to 65 m within the array area, and from around 70 to 0 m below lowest astronomical tide (LAT) along the ECC. A deep narrow channel (~ 15 m water depth) surrounded by bedrock marks the channel of Milford Haven. Offshore, the seabed is, in summary, an area of rippled seabed with distinct and large bedform sandwave features
Current Speeds	Within the array area: Mean spring tide – 0.6 to 0.8 m/s. Increases with distance along the ECC, towards the coastline nearshore (< 1.0 to 1.4 m/s). Decreases again within Milford Haven itself (0.4 to 0.6 m/s). Distance of tidal excursion varies.
Tidal Excursion (mean spring tide)	Within the array area: ~10 km. Middle section of the ECC (KP20): ~ 14 to 15 km. Nearshore section of the ECC: - ~ 18 to 19 km.
Seabed Sediments	Within the array area: Majority of stations represented by the EUNIS BSH A5.2 (sand and muddy sand), and some stations as Gravelly Sand (A5.1 coarse sediment) or Mud and Sandy Mud (A5.3 Sublittoral Mud). Middle section of the ECC (KP20) - Majority of stations dominated by sands but with some inter-station variation. Nearshore section of the ECC - Higher mud fraction close to shore.
Suspended Sediment Concentration (SSC)	Range from 26 water quality samples = < 5 mg/L to 23 mg/L. Under WFD reference values, most of the samples had SSC indicating clear seawater (<10 g/L).
Sediment Quality	Within the array area: Concentrations of determinands in the subtidal sediments across the Study Area were consistently lower than those recorded in the Celtic Sea Region under OSPAR "*Levels and trends in marine contaminants and their biological effects monitoring programme*" (OSPAR, 2019).

9.5.4.2 For full detailed descriptions of the coastal processes and physicochemical properties of the subtidal sediments of the Study Area, refer to Chapter 6: Marine and Coastal Processes and Chapter 7: Marine Seabed and Water Quality.

9.5.5 Biological Environment

Subtidal

9.5.5.1 A diverse subtidal benthic community was identified across the nearfield Study Area from the 2020 grab sampling and DDV survey campaign (OEL, 2021). From the grab samples a total of 246 taxa were recorded, but with a mean per station of approximately only 18 taxa and 109 individuals. Abundances ranged from <20 individuals per grab (ST011, ST018, ST019, ST020, ST021, ST022, ST024, ST026, ST028, ST030, ST039, ST042, ST080, ST083, ST086, and ST113) to >500 per grab (ST051, ST061, and ST070), and richness ranging from just 1 taxa (ST024), to 58 per grab (ST031). The high number of taxa, but also wide range in abundances and richness recorded is likely a natural artefact of differences in sediments across the survey area, supporting different sets of species assemblages. Communities were sampled by grab across the sedimentary areas of the near-field Study Area, and thus will be dominated by infaunal species.

9.5.5.2 Spatial variation in abundances reported highest counts at nearshore stations and within the array area. The most abundant species sampled overall was the bivalve *Kurtiella bidentata* where it accounted for 27% of total abundance. Juveniles of the echinoderm Amphiuridae (brittlestar) were also important, where it was frequently recorded in over 70% of all grab samples. The numerical dominance in bivalves was reflected in the biomass, which overall was mainly attributed to the phylum Mollusca, but with offshore stations also dominated by Echinodermata; representative of the brittlestar family Amphiuridae (juveniles and *Amphiura filiformis*), and the sea urchin *Echinocyamus pusillus.*

9.5.5.3 A total of 26 taxa comprised the infaunal communities sampled across, and at the margins of the Turbot Bank sandbank (n = 5 grabs, ST018 – ST022, approximately KP6.5 – KP10.5; see Volume 2, Figure 9.6 and Figure 9.11 for sample station locations), with average abundances of only 10 individuals per grab, and an average richness of 6 taxa was recorded. The most abundant species recorded overall (sum of all 5 grab samples) was the bivalve *Goodallia triangularis* (n = 9) and the sea urchin *E. pusillus* (n =8). Frequently recorded taxa (those that occurred in ≥ 2 stations) was *E. pusillus*, nemertean worms, and the polychaetes *Ophelia borealis, Glycera oxycephala* and *Nephtys cirrosa.*

9.5.5.4 Any FOCI species and other notable taxa identified from the grab samples, are described separately below.

9.5.5.5 Multivariate analysis (Cluster and Similarity Profile Routine (SIMPROF)) of the macrofaunal communities sampled (n = 107 grabs), reported 29 distinct community groupings. For broader interpretation, these communities were further amalgamated (at 20% similarity) into eight broad Macrobenthic Groups, and with four stations identified as outliers (not belonging to a group). The spatial distribution of the Macrobenthic Groups is shown in Volume 2, Figure 9.6 and a summary description in Table 9.13 below.

9.5.5.6 There is a clear spatial demarcation between the nearshore and offshore communities with Group E, comprising 80 stations, representing almost all of the array area, and extending across half of the ECC (predominantly KP18-KP44). In contrast, the nearshore communities show a higher variability as the ECC intersects a variety of sedimentary habitats and gradients.

9.5.5.7 Groups A, B and H were only represented by two stations and comprised very low abundances. The outliers were within West Angle Bay (ST010; KP0); at KP7 (ST019) and KP29 (ST042) along the ECC; and ST103 within the array. For further details on macrobenthic composition in these sediments, refer to Volume 3, Technical Appendix 9.2: Environmental Baseline Report.

9.5.5.8 Biotope mapping, based on the combined assessment of grab, seabed imagery and geophysical data is presented in Section 9.5.6.

Table 9.13 – Summary Description of the Infaunal Macrobenthic groups sampled across the Study Area and their approximate location (KP). Note: Group D was outside of Study Area, close to Sawdern Point and Group H had a further station allocated to it, this was sampled outside of the Study Area

Group	No. Stations	Area	KP(s)	Description
Group A	2	Offshore ECC	9-10; 12-13	Extremely low total abundances overall; polychaete *Polycirrus* sp.
Group B	2	Offshore ECC; array area	15-16	Polychaetes *Nephtys cirrosa; Scoloplos armiger*.
Group C	3	Offshore ECC	10-13	Bivalves *Goodallia triangularis* and *Spisula* juvenile; *N. cirrosa*.
Group E	80	Offshore ECC and array area	18-19; 20-29; 30-44	*K. bidentata* and echinoderms Amphiuridae juveniles; *A. filiformis* and *E. pusillus*.
Group F	6	Near- and offshore ECC	6-7; 8-9; 13-14;16-18; 19-20	Polychaetes *Aonides paucibranchiata* and *Pisione remota*, and nemertean worms.
Group G	3	Nearshore ECC entrance to Milford Haven	1-4	Polychaetes *Polygordius* and *Sphaerosyllis bulbosa* and nematode worms.
Group H	1	Nearshore ECC	1-2	Polychaetes *P. remota* and *S. bulbosa*.

Shallow Subtidal

9.5.5.9 The shallow water subtidal communities overlapping the ECC area of West Angle Bay were dominated by sand-tolerant species; an expected reflection of an environment where mobile fine and coarse sands are present.

9.5.5.10 In the scoured areas of low-lying rock, low amounts of foliose algae were present, with encrusting corraline algae (Family: Corallinaceae) and calcareous tubes of the keel worm *Spirobranchus* spp. Where localised bedrock ridges occurred above the seabed (< 0.5 m), large kelps *Laminaria hyperborea* and *Saccorhiza polyschidides* were attached, and with a dense understory of red algae associated around the holdfasts (Graphic 9.1).

9.5.5.11 Annex I bedrock reef was confirmed as present and extending up to the intertidal zone, and this is detailed further in Section 9.5.7, alongside confirmation of any other FOCI present.

9.5.5.12 Species richness overall, was relatively low at 39 taxa, and was dominated by algae (72%), predominantly species of reds. Fauna were mainly recorded on the sides and top of elevated rock (reef) and comprised low profile epifaunal species of porifera (sponges); ascidians (sea squirts); bryozoan turf; and saddle oysters (Family: Anomidae). The mobile topshell, *Steromphala* sp. (previously named *Gibbula* sp.) was also recorded across the low lying areas and on the reefs.

Biotopes classified for the shallow subtidal waters at West Angle are detailed in Section 9.5.6. For further details on the shallow subtidal habitats and communities, refer to Volume 3, Technical Appendix 9.1: Integrated report (Geophys and Habitat Assessment), Annex 1: West Angle Shallow Subtidal Snorkel Survey Report.

Intertidal

9.5.5.13 The intertidal landfall site at West Angle Bay is an exposed shore comprising a mosaic of rocky and sedimentary habitats, generally supporting low species diversity. The shore is flanked by rocky cliffs and partly covered in lichen and/or angiosperms. A wide expanse of mainly sandy sediments covers areas from the upper shore down to low water, where it forms a corridor through extensive areas of bedrock and boulders.

9.5.5.14 A north to south zonation, as well as a seaward gradient, characterises the rocky areas of the bay. High to moderate energy rocks at the northern and southern ends, grade into densely barnacle encrusted areas, Fucus spiralis, and then Laminaria digitata and fucoids of F. serratus and Ascophyllum nodosum over a mosaic of rock (cobbles to bedrock) in the lower and extreme low. Rock pool microhabitats were also recorded across the mid shore, with Ulva lactuca, Ulva intestinalis and red algae observed. Common assemblages of molluscs comprising limpets Patella vulgata; periwinkles Littorina spp. and the top shells Steromphala spp. were also recorded.

Graphic 9.1 - (TOP LEFT) Fine sand and *Halidrys siliquosa;* (TOP RIGHT) coarse sand and *Laminaria hyperborea*; (BOTTOM LEFT); steep rock with faunal turf and algae; (BOTTOM RIGHT) sand scoured rock (Sources: Volume 3, Technical Appendix 9.1: Integrated report (Geophys and Habitat Assessment), Annex 1: West Angle Shallow Subtidal Snorkel Survey Report)

9.5.5.15 Coarser sediments occur in the upper shore and strandline at West Angle Bay. These were deemed to be barren, whilst worm casts were observed at the surface of the more extensive, finer, sandy sediments. Within these finer sediments, conspicuous fauna recorded from the Phase II sampling included errant polychaetes of the family Phyllodocidae (paddle worms) and cat worms *Nephtys* sp., as well as tubes of *Owenia* sp. and the sand mason worm *Lanice conchilega.*

9.5.5.16 Volume 2, Figure 9.7 shows the orthomosaic imagery analysis for West Angle Bay with examples of the range of intertidal habitats present.

9.5.5.17 Biotopes classified for the intertidal area at West Angle Bay are detailed in Section 9.5.6, Annex I features identified at West Angle Bay are detailed in Section 9.5.7, alongside confirmation of any other FOCI present. For further details on the intertidal habitats and communities recorded, refer to Volume 3, Technical Appendix 9.3: Intertidal Habitat Report.

9.5.6 Biotope Mapping

Subtidal

9.5.6.1 Following a combined analysis of all subtidal imagery, grabs and geophysical data, a total of 19 sedimentary and rock biotopes were mapped for the subtidal areas of the near-field Study Area (Volume 2, Figure 9.8).

9.5.6.2 The dominant sedimentary biotopes identified comprised, primarily, of a complex of two biotopes:

- A5.251 '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand'; and
- A5.351 '*Amphiura filiformis*, *Mysella bidentata Abra nitida* in circalittoral sandy mud'.

9.5.6.3 These characterised the array area and the offshore section of the ECC (KP21-KP44). These biotopes overlap with the spatial distribution of Macrobenthic Group E, that comprised 80 stations in total, and was the dominant community group reported (see Volume 2, Figure 9.6).

9.5.6.4 Verification of the 2020 geophysical data and habitat review of the array area, with the 2021 survey data, also confirmed the presence of a series of boulder fields (total interpreted area of 0.94 km^2), and assigned the additional broadscale sub-habitats of A4.2 and A5.1 (Atlantic and Mediterranean moderate energy circalittoral rock and Sublittoral coarse sediment, respectively) (Volume 3, Technical Appendix 9.1: Integrated report (Geophys and Habitat Assessment), Annex 2: Erebus Array Habitat Review).

9.5.6.5 Along the nearshore areas of the ECC and towards the outer fringes of Milford Haven (KP7-KP19), sediments become coarser and less homogenous, with a mixture of:

- A5.14 'Circalittoral coarse sediment';
- A5.25 'Circalittoral fine sand'; and,
- A5.44 'Circalittoral mixed sediments'.

9.5.6.6 These nearshore sediments supported low faunal abundances of key species and, thus, could only be mapped as EUNIS level 4 biotopes.

9.5.6.7 On the approach to Milford Haven's entrance, leading to the narrow sedimentary channel between rocky substrates (Row's Rocks (KP1-KP6)), the main biotope represented was A5.143 '*Protodorvillea kefersteini* and other polychaetes in impoverished circalittoral mixed gravelly sand'. Turning east, towards the landfall of West Angle Bay (KP0-KP1), and where sediments were deep enough to sample, finer sediments of A5.25 'Circalittoral fine sand' were represented.

9.5.6.8 Rocky habitats were restricted to the nearshore areas of the Study Area (KP0-KP5), with a mosaic of biotopes identified, overlapping Annex I rocky reef (see Section 9.5.7 for associated assessments of Annex I). The dominant rocky biotopes belonged to the BSH A4.1 'Atlantic and Mediterranean high energy circalittoral rock' and comprised:

- A4.13 'Mixed faunal turf communities on circalittoral rock'; and
- A4.131 'Bryozoan turf and erect sponges on tide-swept circalittoral rock.'

9.5.6.9 Moderate energy rocky habitats (A4.2) were also identified within the area (e.g., A4.214 Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock') (Graphic 9.2).

Graphic 9.2 – Example seabed imagery of rock biotope A4.13 (LEFT) and A4.214 (RIGHT) across the Study Area (Source: OEL, 2020)

Shallow Subtidal

9.5.6.10 A total of 7 biotopes were identified within the shallow subtidal areas of West Angle Bay that overlapped the ECC. Here, species assemblages were broadly split by their tolerance to sand scour. In low lying areas, scour tolerant species dominated and in elevated areas of rock, kelps and dense understories of red algae were present. As the specific species that will be present will very along their individual tolerance range, it was reported that the bedrock habitats of the shallow subtidal did not completely align with the MNCR biotope classification but included characteristics of the following four main MNCR (and EUNIS) biotopes, and with a mosaic of these present:

- A3.127 (IR.HIR.KSed.ProtAhn) '*Polyides rotundus*, *Ahnfeltia plicata* and *Chrondrus crispus* on sand-covered infralittoral rock';
- A3.126 (IR.HIR.KSed.XKHal) *'Halidrys siliquosa* and mixed kelps on tide-swept infralittoral rock with coarse sediment' (A3.126);
- A3.125 (IR.HIR.KSed.XKScrR) 'Mixed kelps with scour tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock'; and
- A3.124 (IR.HIR.KSed.DesFilR) 'Dense *Desmarestia* spp. with filamentous red seaweeds on exposed infralittoral cobbles, pebbles and bedrock'.

9.5.6.11 These four biotopes fall under the broader classification of A3.12 (IR.HIR.KSed) 'Sediment-affected or disturbed kelp and seaweed communities'. This habitat was also recorded in the subtidal benthic surveys, just north of West Angle Bay (Transect 3). Only one station recorded the biotope A3.115 (IR.HIR.KFaR.LhypRVt) '*Laminaria hyperborea* and red seaweeds on exposed vertical rock'. Here steep sided bedrock and eroded surfaces provided suitable habitats for sponges, sea squirts and bryozoan turf, and although only recorded once, it is likely present on any of the larger bedrock ridges in the shallow subtidal area.

9.5.6.12 The dominant sediment biotope assigned to these shallow subtidal areas was A5.231 (SS.SSa.IFiSa.IMoSa) 'Infralittoral mobile clean sand with sparse fauna'. This mirrors the sedimentary habitats recorded via the intertidal survey (A2.231; see Table 9.14 below) and data from the subtidal grab samples of deeper sediments in the Bay that indicate fine sands as present. Coarse sands were also recorded in the shallow water surveys, and these were assigned to A5.13 (SS.SCS.ICS, 'Infralittoral coarse sediment').

Intertidal

9.5.6.13 The intertidal area of West Angle Bay supports a wide variety of littoral rock and sedimentary habitats. A total of 29 biotopes were mapped, and Table 9.14 lists the key biotopes identified from 12 BSH. At the top of the site, a sea wall sea defence (J4.6) sits behind the upper shore comprised of shingle and gravel (A2.11) including barren shingle (A2.111), which gives way to a narrow strandline (A2.21) and then a wide area of littoral sand and muddy sand (A2.2) grading into rocky features of a range of exposures (A1.1, A1.2, A1.3). Features of littoral rock including rock pools (A1.41 and A1.42) are also ascribed and the flanks are bordered by supralittoral rock (B3.11) and rocky cliffs and ledges (B3.2). Volume 2, Figure 9.9 shows the distribution of biotopes classified at West Angle Bay.

Table 9.14 – Key EUNIS biotopes recorded at West Angle Bay

EUNIS BSH	EUNIS Code	Descriptions
A1.1-High energy Littoral Rock	A1.113	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock
A1.2-Moderate energy Littoral Rock	A1.212	*Fucus spiralis* on full salinity exposed to moderately exposed upper eulittoral rock
	A1.214	*Fucus serratus* on moderately exposed lower eulittoral rock
A1.3-Low energy Littoral Rock	A1.314	*Ascophyllum nodosum* on very sheltered mid eulittoral rock
A1.4-Features of Littoral Rock	A1.41	Communities of littoral rockpools
	A1.42	Communities of rockpools in the supralittoral zone
	A1.45	Ephemeral green or red seaweeds (freshwater or sand-influenced) on non-mobile substrata
A2.1-Littoral Coarse Sediment	A2.11	Shingle (pebble) and gravel shores
	A2.111	Barren littoral shingle
A2.2-Littoral Sand and Muddy Sand	A2.21	Strandline
	A2.22	Barren or amphipod-dominated mobile sand shores
	A2.23	Polychaete/amphipod-dominated fine sand shores
	A2.231	Polychaetes in littoral fine sand
	A2.245	*Lanice conchilega* in littoral sand
A2.4 - Littoral mixed sediments	A2.4	Littoral mixed sediments

EUNIS BSH	EUNIS Code	Descriptions
A3.2 - Atlantic and Mediterranean moderate energy infralittoral rock	A3.2111	*Laminaria digitata* on moderately exposed sublittoral fringe bedrock
B3.1 - Supralittoral rock (lichen or splash zone	B3.11	Lichens or small green algae on supralittoral and littoral fringe rock
	B3.111	Yellow and grey lichens on supralittoral rock
B3.2 - Unvegetated rock cliffs, ledges, shores and islets	B3.23	Temperate Atlantic sea-cliffs and rocky shores
B3.3 - Rock cliffs, ledges and shores, with angiosperms	B3.3	Rock cliffs, ledges and shores, with angiosperms
J4.6 - Pavements and recreation areas	J4.6	Pavements and recreation areas

9.5.7 Features of Conservation Interest

Annex I Reef – Stony / Bedrock

9.5.7.1 Annex I rocky reef assessments, across the subtidal areas of the near-field Study Area, identified stony and bedrock reef within the nearshore section of the ECC, in areas where rocky substrates were more common (Volume 2, Figure 9.10).

9.5.7.2 Annex I subtidal reef was predicted to overlap the Study Area within the SAC, by 3.04 km^2, and outside of the SAC boundary by 0.40 km^2 (Lle Geo Data Portal, 2021). However, based on data collected via the project-specific surveys (OEL, 2021; CALM; 2021), this was refined; showing that the extent of Annex I reef in the near-field Study Area, present within the SAC boundary, was less at 0.96 km^2 (Table 9.15).

9.5.7.3 Annex I intertidal reef was predicted across the intertidal area of the Survey Area and following baseline surveys this was mapped and calculated to be 0.084 km^2.

Table 9.15 – Annex I subtidal stony/bedrock Reef in near-field Study Area

Feature	Area (km^2) of Feature that overlaps near-field Study Area <u>inside</u> SAC boundary	Area (km^2) of Feature that overlaps near-field Study Area <u>outside</u> SAC boundary	Source
Subtidal Stony/ Bedrock reef	3.04 km^2	0.40 km^2	LLe Geo-Data Portal, 2021
	0.96 km^2	0.00 km^2	Erebus site surveys (OEL 2021; CALM; 2021)

9.5.7.4 Stony reefs, following the criteria of Irving (2009), were either classified as 'low' or 'medium' reefiness, with no 'high' quality reef identified. Where stony and bedrock reefs were recorded along the same transect, they were deemed to form mosaics, and thus were difficult to differentiate with the lack of clear boundaries in the acoustic geophysical data.

9.5.7.5 In total, 15 transects showed evidence of rocky reef, all being within the nearshore ECC areas (KP1-KP4). Three additional transects, T_098 and T_99 (along with T_097), were surveyed following indication of potential reef at T_20 (Table 9.16).

9.5.7.6 For assessment of stony reef, two transects was deemed to just represent medium reef (T_019 and T_099) (KP51), three containing features of low reefiness, and four a mixture of both low and medium reefiness.

9.5.7.7 Bedrock reef was solely identified across three transects, but otherwise formed a mosaic with stony reef at the remaining seven transects. Bedrock was more commonly recorded at the nearshore stations, and an indicative pattern of decreasing occurrences of medium quality stony and bedrock reef, with distance from the coast, was shown. All transects along their lengths had areas that were assessed as not qualifying as reef, with exception of T_005 and T_008.

Table 9.16 – Summary of Annex I Reef assessment for stony and bedrock reef for each HA transect along which reef was observed and biotopes ascribed (Note T_003 is situated outside of the Survey Area boundary but had been surveyed as part of the baseline surveys)

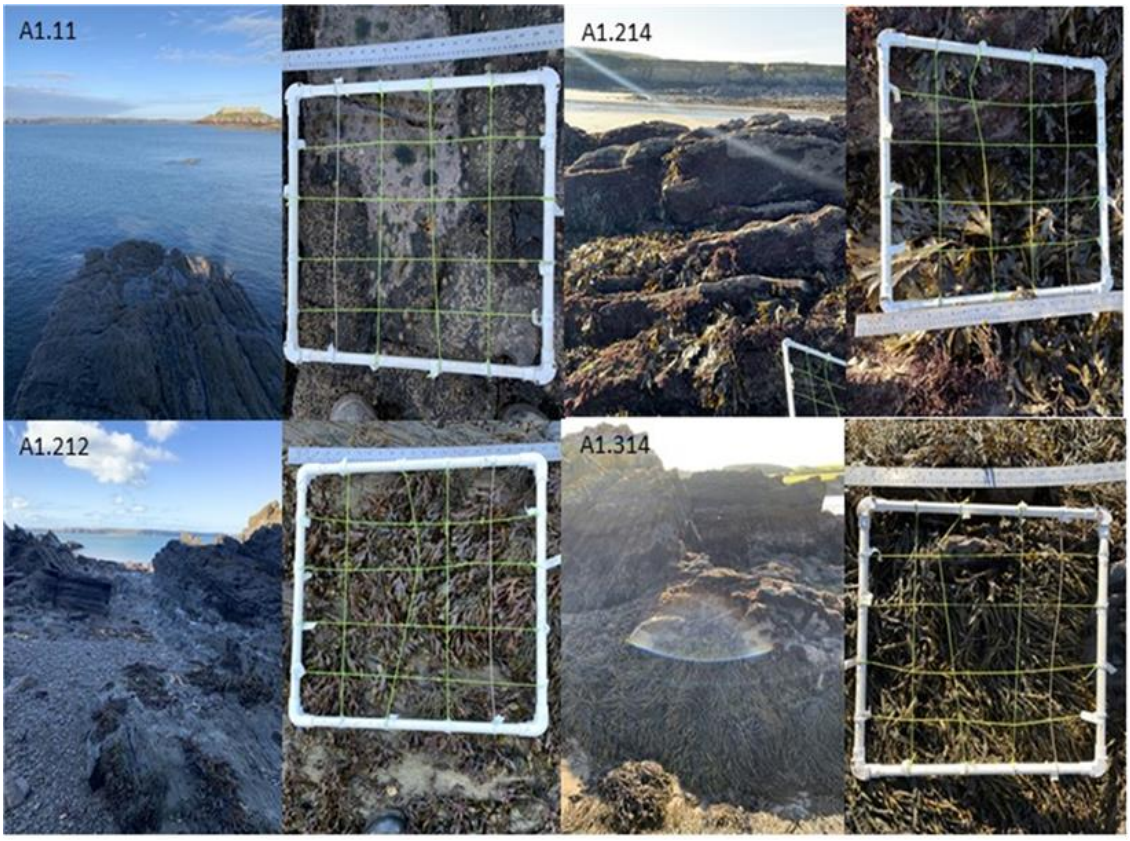
HA Transect	EUNIS Habitat	Stony				Bedrock
		Not a reef	Low	Medium	High	
T_004	A3.115, A3.116, A4.13, A4.214	7	-	2	-	9
T_005	A3.115, A3.116, A4.212	-	-	5	-	17
T_006	A4.214	7	4	-	-	3
T_007	A4.13, A4.212, A4.214	9	14	5	-	13

HA Transect	EUNIS Habitat	Stony				Bedrock
		Not a reef	Low	Medium	High	
T_008	A4.13, A4.131, A4.214	-	-	11	-	12
T_009	A3.115, A3.116, A4.13, A4.131, A4.212, A4.214	16	-	5	-	18
T_010	A4.13, A4.131	8	2	1	-	16
T_016	A4.13	23	-	-	-	4
T_017	A4.13, A4.131	14	-	-	-	7
T_018	A4.13, A4.214, A4.221	21	4	-	-	-
T_019	A4.214	21	5	1	-	-
T_020	A5.14/A4.214, A5.14/A4.213	92	3	-	-	-
T_026	A4.1	37	-	-	-	1
T_098	A5.14/A4.214	74	5	-	-	-
T_099	A5.14/A4.214, A5.14/A4.213	35	10	1	-	-

9.5.7.8 At West Angle Bay, large intertidal areas of a mosaic of exposed bedrock, boulders and cobbles were present, and were deemed to be representative of Annex I rocky reef features (bedrock and stony) (Graphic 9.3). However, the subtidal surveys (OEL, 2021) did not show any evidence in the nearshore waters, aside from images of kelp on sublittoral rock (T_013). The presence of Annex I stony reef habitat was confirmed following the shallow subtidal snorkel surveys in the bay, that demonstrated that there was an extension of bedrock reef from the intertidal into the shallow subtidal (Volume 3, Technical Appendix 9.1: Integrated report (Geophys and Habitat Assessment), Annex I: West Angle Shallow Subtidal Snorkel Survey Report).

9.5.7.9 The shallow subtidal survey reported patchy but extensive bedrock, which comprised 70% of the 100 m by 10 m survey corridor. Boulders and cobbles were also present but the subtidal extent was not significant enough to be defined as Annex I stony reef habitat.

9.5.7.10 All intertidal rock biotopes classified at West Angle Bay supported features of Annex I rocky reef habitat. Across the intertidal area, this encompassed an approximate extent of 84,021 m^2 (0.084 km^2). See Volume 2, Figure 9.9 and Table 9.14 for reference.



Graphic 9.3 – Example images of Annex I rocky reef habitats of West Angle Bay (Volume 3, Technical Appendix 9.3: Intertidal Habitat Report)

Annex I Reef- biogenic

9.5.7.11 No Annex I biogenic reef was observed across the subtidal, shallow subtidal and/or intertidal Survey Area.

9.5.7.12 Discrete *Sabellaria spinulosa* aggregations were observed at T_018 (KP6-KP7), and T_026 within the offshore ECC (KP13-KP14). At both these transects, they were only observed as a single occurrence, though were locally assigned biotopes A4.221 *Sabellaria spinulosa* encrusted circalittoral rock and A5.611 *Sabellaria spinulosa* on stable circalittoral rock, respectively. Due to the limited extent of these features, they were not deemed to qualify as reef, based on the Gubbay (2007) criteria.

9.5.7.13 Eleven individuals of *S. spinulosa* were recorded from single subtidal grab sample (ST031) in the middle section of the ECC (KP18). It was observed that these individuals occurred in solitary form and had not formed aggregations. Across the shallow subtidal waters, and intertidal area of West Angle Bay, no reef building species were recorded (e.g., *Sabellaria alveolata*).

Annex I Sandbanks

9.5.7.14 Annex I sandbanks was predicted to overlap the ECC in the near-field Study Area by 0.46 km^2 within the SAC, and (under Article 17) 1.16 km^2 outside of the SAC (the Turbot Bank sandbank) (Volume 2, Figure 9.4a).

9.5.7.15 There are sandwave features (including megaripples) along the ECC and across the northwest section of the array area, and these were not assessed as Annex I. Following the baseline surveys, two areas of subtidal sandy habitat were identified across the Study Area as requiring further assessment under Annex I.

9.5.7.16 In consideration of the criteria described by Pinder (2020), one sandbank was assigned a 'High' confidence score due to its topographic and sedimentary characteristics, and because it formed part of the known Turbot Bank Sandbank. Ground-truthed data reported that the ECC intersects this 19.1 km^2 feature by approximately 1.56 km^2 (KP6.5- KP10.5) (Table 9.17).

9.5.7.17 The second feature was identified further along the near-field Study Area ECC (approximately KP15 – KP18), overlapping it by 1.03 km^2. This feature was deemed to meet the topographic and sedimentary criteria, but was assigned a 'Potential' confidence score due to the lack of known adjacent sandbanks. The assessment of this second feature, and any potential impacts on this feature, will be discussed with consideration of its deeper depth, determined from bathymetry as being >20 m.

Table 9.17 - Annex I Subtidal Sandbank in the Study Area

Feature	Area (km^2) of Feature that overlaps near-field Study Area <u>inside</u> SAC boundary	Area (km^2) of Feature that overlaps near-field Study Area <u>outside</u> SAC boundary	Source
Subtidal Sandbank (Turbot Bank)	0.46 m^2	1.16 km^2	LLe Geo-Data Portal, 2021
	0.34 km^2	1.23 km^2	Erebus site surveys (OEL 2021)

9.5.7.18 Volume 2, Figure 9.11 shows the location of the two features, which are located approximately between KP6.5 and KP10.5 (Turbot Bank), and KP15 and KP18. These areas were predominantly classified by the following biotopes: A5.25 (fine sands); A5.14 (coarse sediment); and partially A5.44 (mixed sediments, around KP18), supporting the classification type of 'gravelly sands' ascribed to this feature for the SAC. Infaunal communities sampled across Turbot Bank sandbank, and its margins by grabs, were characterised by low abundances of the echinoderm *E. pusillus*, bivalves *G. triangularis*, cat worm *N. cirrosa,* and the polychaetes *Ophelia borealis* and *Glycera oxycephala*.

<u>Annex I Mudflats and Sandflats</u>

9.5.7.19 The extensive intertidal sandy sediments across West Angle Bay, were deemed to be representative of Annex I mudflats and sandflats, and covered an extent of approximately 57,751 m^2 (0.058 km^2). Based on the UAV imagery and Phase II data, this feature was assigned the type of 'clean sands', supporting an assemblage of amphipod crustaceans and polychaete worms

9.5.7.20 Biotopes representative of this Annex I features belonged to the BSH A2.2 littoral sand and muddy sand (Graphic 9.4), and excluded the coarse habitats of BSH A2.1 (littoral coarse sediment) and A2.4 (littoral mixed sediments) (see Table 9.14 above for reference).

Graphic 9.4 – Sandy sediments (LEFT) and example images of Annex I mudflats and sandflats biotopes with worm casts and burrows visible (RIGHT) at West Angle Bay (Volume 3, Technical Appendix 9.3: Intertidal Habitat Report)

Annex I Sea caves

9.5.7.21 Sea caves are present across the Pembrokeshire coastline (see Volume 2, Figure 9.4a). At West Angle Bay there was only one sea cave recorded, and this habitat was assigned the biotope A1.44C 'Pontic mediolittoral caves with *Hildebrandia*, *Phymatolithon*, *Lithophyllum,* bryozoans, *Pachygrapsus, Eriphia*', which belongs to its parent classification of A1.44 'Communities of littoral caves and overhangs' (MNCR LR.FLR.CvoV). This feature was observed as having a shingle bottom, with encrusting barnacles present (Graphic 9.5).

9.5.7.22 The feature recorded is a cave due to its size (larger than a crevice), but with a single entrance and relative limited extent, associated low species diversity, and isolated as it is the only one observed. The indicative condition assessment of sea caves within the SAC is currently unknown, as no surveys have been undertaken since 2002 to assess structure, function and typical species, but it is assumed that distribution and extent have remained unchanged since designation (NRW, 2018b).

9.5.7.23 This feature of littoral rock observed at West Angle Bay is a feature of the wider assigned reef habitat present, but with a single observation. It is not a notable characteristic of the landfall, and with its proximity, away from the indicative cable routes across the West Angle Bay, will not be assessed any further.

Graphic 9.5 – Sea cave at West Angle Bay (Volume 3, Technical Appendix 9.3: Intertidal Habitat Report)

Annex II Shore Dock

9.5.7.24 There were no recordings of shore dock *R. rupestris* across the intertidal area of West Angle Bay.

Section 7/OSPAR

9.5.7.25 Section 7 'Sublittoral sediments of subtidal sands and gravels' are present across the sand dominated sediments of the Project (e.g, the offshore ECC). These sediments were represented by the mosaic of two sandy biotopes, which included A5.251 '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand.'

9.5.7.26 The nearshore ECC overlaps predicted areas of Section 7 'Sublittoral sediments: subtidal mixed muddy sediments', by approximately 2.6 km^2 (as shown in Volume 2, Figure 9.5) and these features are likely associated with the A5.44 circalittoral mixed sediments biotopes mapped along the Survey Area.

9.5.7.27 No Section 7/ OSPAR *Ostrea edulis* beds were identified across the near-shore Survey Area, however shells were observed between KP4 and KP6 (T_020; T_097; T_98 and T_099) in the nearshore section of the subtidal ECC, associated with the EUNIS biotope complex A5.14 'Circalittoral coarse sediment'. Of the 27 images retrieved, most of them (20) were not deemed to be alive, however, this was difficult to determine and furthermore, no individuals were retrieved from the grabs that could be examined.

9.5.7.28 No other subtidal Section 7 or OSPAR habitats and species were recorded from the subtidal, and shallow subtidal areas of the near-field Study Area (see Volume 3, Technical Appendix 9.1: Integrated report (Geophys and Habitat Assessment), Annex I: West Angle Shallow Subtidal Snorkel Survey Report).

9.5.7.29 The intertidal survey identified the Section 7 'Littoral Rock: Intertidal under boulder communities' habitat. Where present, these were supporting mixed assemblages of gastropods, barnacles and fucoids. Across the splash zone, the coastal Section 7 habitat 'Supralittoral rock: Maritime cliff and slopes' was also represented.

9.5.7.30 Upstream of the near-field Study Area, within the far-field Study Area of Milford Haven, other Section 7 or OSPAR habitats are expected to be present (see Volume 2, Figure 9.5), and these include:

- Section 7 Estuarine rock (Angle Bay);
- Section 7/OSPAR Maërl beds (northern side of the Haven);

- Section 7/OSPAR Intertidal mudflats (Angle Bay and Pwllcrochan Flats);
- Section 7 Sheltered muddy gravels (Angle Bay and Pwllcrochan Flats);
- Section 7/OSPAR Seagrass beds (e.g. Angle Bay);
- Section 7 Saltmarsh (e.g, Dale); and
- Section 7 Saline lagoon (e.g., Dale).

9.5.7.31 These designated features present within the far-field Study Area, will be considered where applicable, and primarily in relation to potential secondary impacts from suspended sediment plumes during the construction phase.

INNS

9.5.7.32 From the project specific baseline surveys (subtidal, shallow subtidal and intertidal), the key INNS recorded were 13 individual slipper limpets *Crepidula fornicata*, near the Sawdern Point landfall option (which is now no longer within the consent boundary).

9.5.7.33 The slipper limpet *Crepidula fornicata* can be present across subtidal and intertidal areas, and it will migrate between these zones. Within the region, its distribution is indicated to be mainly restricted to within Milford Haven itself, where it has been established since the 1950s (NBN, 2021; Bohn, 2014).

9.5.7.34 Thus, even though not within the immediate study area, there is a likelihood of INNS taxa being present along the nearshore and intertidal Study Area, and/or having the opportunity to become introduced in the future.

9.5.7.35 The non-native barnacle *Austrominius modestus* has been resident in Milford Haven since the 1940s (Crisp, 1958). *A. modestus* has a higher density of occurrences within the estuary, than the coastal areas; however, records of this species are reported for West Angle Bay (NBN, 2021) and, as barnacles were recorded at the landfall site, are likely to be present. Natural environmental pressures are likely to naturally restrict the distribution of this species, where it will compete with species such as *Chthalamus* sp. and the larger *Balanus perforatus* (Bunker, 2015).

9.5.7.36 There are a number of records, dating back to 1998, of the presence of wireweed *Sargassum muticum* along the northern edge of West Angle Bay, and also the highly invasive kelp *Undaria pinnatifida* (Wakame) in Angle Bay, located further upstream (NBN, 2021). These low shore, sublittoral species were not identified in the baseline surveys, but it may be expected that distributions will overlap with West Angle Bay over the Project lifetime.

Other notable Species

9.5.7.37 A single record of the shrimp *Solenocera membranacea* was recorded at ST75, within the boundary of the array area. *S. membranacea* is not a protected species, however it is typical of the Mediterranean, with no accounts presently reported of this in UK waters (NBN, 2021). The thumbnail crab *Thia scutellata* was recorded once, at ST69 within the northern 1 km buffer of the array area. This species has a wide distribution in English waters and is recorded around the English coast; however, it is a Nationally Scarce Species (NBN, 2021).

9.5.8 Valued Ecological Receptors

9.5.8.1 Following the approach outlined in Section 9.4.7, the biotopes and Annex I habitats and Section 7/OSPAR habitats identified from the baseline surveys have been split across 12 broad community and habitat types (A-L) – see Table 9.18.

9.5.8.2 To summarise, eight of these 12 Valued Ecological Receptors (VERs) comprised rocky habitats with high degree of partitioning across the intertidal (littoral) biotopes. This partitioning predominantly reflects differences in exposure, but also microhabitats such as rock pools and ephemeral seaweeds on disturbed rock that exhibit unique sensitivities and characteristics.

9.5.8.3 The remaining four VERs comprised sedimentary habitats, partitioned by a combination of depth and sediment type (e.g. coarse vs. fines).

9.5.8.4 A description of each VER, and general characteristics, has been provided in Table 9.18. The presence of FOCIs for each VER has also been listed. These have been noted in reference to the baseline survey data, with site specific information referred to, where required, for the definite presence of Annex I feature within a given location, and in consultation with the expected distribution as presented in Volume 2, Figure 9.9, Figure 9.10 and Figure 9.11.

9.5.8.5 Volume 2, Figure 9.12 (a-b) shows the spatial distribution of the VER groupings throughout the near-field Study Area, with the BSH mapped across the far-field and regional areas, for reference. A mosaic of VERs is present across the intertidal landfall site at West Angle Bay, compared with the offshore areas of the ECC and the array area, that were dominated by VER group L.

Table 9.18 – Valued Ecological Receptors within the Project coastal and marine ecology Study Area, their conservation status and Importance. Broad groupings and biotopes are colour coded by substrate type and/water depth

VER Group	Name	Representative EUNIS code(s)	Annex I	HPI Section 7/OSPAR	Summary Descriptions
Supralittoral to Infralittoral Rock					
A	Supralittoral rock with lichen	**B3.1** Supralittoral rock (lichen or splash zone) • B3.11 • B3.111 **B3.23** Temperate Atlantic sea-cliffs and rocky shores **B3.3** Rock cliffs, ledges and shores, with angiosperms	No	Include features of Maritime cliff and slopes	Supralittoral rock or bedrock with patches of lichen growth. Generally, has no or low sensitivity to pressures apart from physical pressures, where these biotopes have a high sensitivity and low resilience and resistance.
B	High energy littoral and infralittoral rock subject to exposed to extremely exposed wave action or strong tidal streams.	**A1.1** High energy littoral rock • A1.11 **A3.1** Atlantic & Mediterranean high energy infralittoral rock • A3.11 • A3.115 • A3.116 • A3.12 • A3.125	Includes sub-features of Reef (H1170) (rocky)	Include features of: Intertidal under boulder communities	Littoral and Infralittoral habitats typically supporting a community of kelp *Laminaria hyperborea* with foliose seaweeds and animals or sponges and barnacles, the latter tending to become more prominent in areas of strongest water movement. The communities within this group are exposed to a high energy environment and are highly tolerant due the variability of the environment such as those in high energy littoral rock habitats. Medium to high sensitivity to hydrological pressures, physical pressures, and some biological pressures. With low resilience and resistance to the pressures.

VER Group	Name	Representative EUNIS code(s)	Annex I	HPI Section 7/OSPAR	Summary Descriptions
C	Moderate energy littoral and infralittoral rock subject to moderately exposed wave action and/or moderate-weak tidal streams. Communities can comprise faunal and algal crusts on bedrock.	**A1.2** Moderate energy littoral rock • A1.212 • A1.214 **A3.2** Atlantic and Mediterranean moderate energy infralittoral rock • A3.21 • A3.211	Includes - features of Reef (H1170) (rocky)	Include features of: Intertidal underboulder communities	These biotopes typically occur on the upper and vertical faces of wave-exposed, moderately strong to weakly tide-swept, bedrock or boulders. Generally low sensitivity to hydrological pressures but does have high sensitivity to some physical and climate pressures. With low resilience and resistance to the pressures. Rock surface tends to have a grazed appearance; this may be partially attributable to the abundance of grazers. Has high sensitivity to climate change and physical pressures. Has low resilience and resistance for physical loss and change to another seabed type.
D	Low energy littoral rocky habitat subject to low levels of wave action and/or low tidal streams	**A1.3** Low energy littoral rock • A1.314	Includes features of: Reef (H1170) (rocky)	Include features of: Intertidal underboulder communities	Low energy intertidal rock. Some sensitivity to climate and physical pressures, with low resilience and resistance to the pressures. Some sensitivity to hydrological pressures and high sensitivity to some physical and biological pressures. Has low resilience and resistance to the pressures.
E	Intertidal littoral rock pools	**A1.4** Feature of littoral rock (rock pools) • A1.41 • A1.42	Includes features of: Reef (H1170) (rocky)		A feature of littoral rock present across a range of wave exposures, where topography of shore allows seawater retention within depressions in the bedrock to create pools. Due to location, these features are generally not sensitive to hydrological pressures and have a medium-high resilience. Rock pools are highly sensitive to physical loss/change from physical

VER Group	Name	Representative EUNIS code(s)	Annex I	HPI Section 7/OSPAR	Summary Descriptions
					pressures, with a very low resilience and no resistance. Pools are not as sensitive to physical pressures from changes in suspended solids, smothering/siltation, and have a medium-high resistance.
F	Intertidal ephemeral seaweeds on disturbed littoral rock	**A1.45** Ephemeral green or red seaweeds (freshwater or sand-influenced) on non-mobile substrata	Includes features of: Reef (H1170) (rocky)	Include features of: Intertidal underboulder communities	A feature of littoral rock where ephemeral algal mats (red and green) are present on disturbed (unstable, sand-scoured or fresh-water influenced) rock. Variations in community present can be associated with wave and salinity exposure. Few species, and of low abundance, are present in such habitats. These features are generally not sensitive to hydrological pressures, with a high resilience and resistance to such pressures. These features have a high sensitivity, very low resilience and no resistance to physical pressures of habitat change or loss, but a generally low sensitivity and high resilience to physical pressures such as abrasion or changes in suspended solids and smothering.
Circalittoral Rock					
G	High energy circalittoral rock subject to exposed to extremely exposed wave action or strong tidal streams.	**A4.1** Atlantic and Mediterranean high energy circalittoral rock & • A4.13 • A4.131	May include features of Reef (H1170) (rocky)	No	Circalittoral habitats typically support a community of animals or sponges and barnacles, the latter tending to become more prominent in areas of strongest water movement. The communities within this group are exposed to a high energy environment and are highly tolerant due the variability of the

VER Group	Name	Representative EUNIS code(s)	Annex I	HPI Section 7/OSPAR	Summary Descriptions
					environments. Medium to high sensitivity to hydrological pressures, physical pressures, and some biological pressures, and with low resilience and resistance to the pressures.
H	Moderate energy circalittoral rock subject to moderately exposed wave action and/or moderate-weak tidal streams. Communities can comprise faunal and algal crusts on bedrock.	**A4.2** Atlantic and Mediterranean moderate energy circalittoral rock • A4.21 • A4.212 • A4.214 • A4.215	May include features of Reef (H1170) (rocky)	No	These biotopes typically occur on the upper and vertical faces of wave-exposed, moderately strong to weakly tide-swept, bedrock or boulders. Generally low sensitivity to hydrological pressures but do have high sensitivity to some physical and climate pressures. Low resilience and resistance to the pressures. Rock surfaces tend to have a grazed appearance; this may be partially attributable to the abundance of grazers such as *Echinus esculentus* (circalittoral). Has high sensitivity to climate change and physical pressures. Has low resilience and resistance for physical loss and change to another seabed type.

VER Group	Name	Representative EUNIS code(s)	Annex I	HPI Section 7/OSPAR	Summary Descriptions
Littoral to Circalittoral Sediment					
I	Littoral to circalittoral very coarse sediments subject to wave/tidal actions	**A2.1** Littoral coarse sediment & • A2.11 • A2.111 **A5.1** Sublittoral coarse sediment • A5.13 • A5.14 • A5.143 • A5.15	May include features of: Sandbanks which are slightly covered by seawater all the time (H110)	No	Coarse sediments (littoral to circalittoral) including coarse sand, gravel, pebbles, shingle and cobbles which are often unstable due to tidal currents and/or wave action. Some sensitivity to climate and physical pressures, with low resilience and resistance to the pressures.
J	Littoral to circalittoral mixed sediments	**A2.4** Littoral mixed sediment **A5.43** Infralittoral mixed sediments • A5.431 **A5.44** Circalittoral mixed sediments	No	Include features of: Subtidal mixed muddy sediments	Shallow water mixed (heterogeneous) sediments, in fully marine or near fully marine conditions, supporting various animal-dominated communities, with relatively low proportions of seaweeds. This habitat may include well mixed muddy gravelly sands or very poorly sorted mosaics of shell, cobbles and pebbles embedded in mud, sand or gravel. Generally, no or low sensitivity to most pressures apart from physical pressures, where these biotopes have a high sensitivity and low resilience and resistance.

VER Group	Name	Representative EUNIS code(s)	Annex I	HPI Section 7/OSPAR	Summary Descriptions
K	Littoral fine sand/muddy sand	**A2.2** Littoral sand and muddy sand • A2.21 • A2.22 • A2.23 • A2.231 • A2.245	Includes features of: Mudflats and sandflats not covered by seawater at low tide (H1140)	No	Clean medium to fine sands or non-cohesive slightly muddy sands from the strandline on open coasts, or in estuaries and marine inlets. Generally, no or low sensitivity to most pressures apart from physical and biological pressures, where these biotopes have a high sensitivity and low resilience and resistance.
L	Circalittoral fine sand/muddy sand	**A5.2** Subtidal sand • A5.23 • A5.25 • A5.251 • A5.27 **A5.3** Sublittoral mud • A5.31 • A5.35 • A5.351	May include features of: Sandbanks which are slightly covered by seawater all the time (H110)	Includes features of Subtidal Sands and Gravels	Clean medium to fine sands or non-cohesive slightly muddy sands from offshore or in estuaries and marine inlets. Generally, no or low sensitivity to most pressures apart from physical and biological pressures, where these biotopes have a high sensitivity and low resilience and resistance.

9.5.9 Data Gaps and Uncertainties

9.5.9.1 The baseline surveys have provided an extensive spatial coverage of the benthic ecology near-field Study Area. It is noted that these were taken within a single year/season and will not provide any indication of the natural variation in communities supported across these range of habitats. However, as their purpose was to characterise the site for EIA purposes, the information derived is sufficient.

9.5.9.2 Some of the wider sources of information, such as data available from on-line portals, or the monitoring and condition assessments of Annex I features within the SAC, are dated. As such there may be constraints for assessing the potential pressures arising from the Project on sensitive receptors in terms of understanding potential responses to these effects.

9.6 Potential Environmental Effects

9.6.1 Overview

9.6.1.1 The following assessment provides a summary of all impacts identified during Scoping, and those which have been noted as the EIA has progressed. Each impact is not necessarily relevant to all stages of the Project, and thus impacts have been assessed within the stage of the Project at which they will occur (construction, O&M, and decommissioning). Further information of the EIA process and methodology is outlined in Section 9.4.8 and Chapter 2: Overview of EIA methodology. The impacts have been assessed on the current baseline, which could change over the operational life of the project. The worst-case parameters assumed for each individual potential impact on benthic ecology are detailed separately below. Further information on the PDE is described in Chapter 4: Proposed Development Description.

9.6.1.2 Biotope mapping of the near-field Study Area recorded a range of rocky and sedimentary habitats, and following the process of assigning each biotope to a VER receptor group, 12 VERs have been identified (VER groups A-H rock, and VER groups I-L sediment) (see Table 9.18; Volume 2, Figure 9.12). For the assessment of potential effects on sedimentary and rock benthic habitats, via the impacts scoped in for assessment consideration will be focused on the dominant VER groups, and those likely to be interact with proposed works (directly or indirectly). For discrete areas mapped as Annex I habitat, these are separately assessed where appropriate, and are assessed within Volume 3, Technical Appendix 8.3: Report to Inform Appropriate Assessment (RIAA).

9.6.1.3 For assessment of impact on each VER group(s), the magnitude of impact will be assessed separately where appropriate, to account for variation in sediment types, tidal excursions and benthic habitats within different parts of the Study Area, where these impacts may arise

9.6.2 Construction

9.6.2.1 Under the construction and installation phase, the following potential impacts have been assessed:

- Temporary habitat disturbance during installation (direct and indirect);
- Temporary increases in suspended sediment/smothering (indirect);
- Introduction of INNS (indirect):
- Protection of benthic habitats from fishing restrictions (indirect); and

- Accidental release of contaminants through disturbance of the sediments (indirect).

Temporary Habitat Disturbance during Installation Activities

9.6.2.2 Table 9.19 summarises the realistic worst case scenario for temporary habitat disturbance during the construction phase of the Project.

Table 9.19 - Summary of area (m^2) of temporary habitat disturbance (construction)

Realistic Worst Case Scenario	Justification
Array Area • Approximate duration of all array works: 210 days; • Array area: 43.5 km^2; • Area of seabed impacted by embedment anchors: 234,150 m^2; • Area of seabed impacted via array cable installation: 285,000 m^2; • Area of potential sandwave clearance within array area: 20,300 m^2 (<3 km). • Area of navigation aid/ADCP moorings: 500 m^2 Offshore Export Cable • Approximate duration of all export cable works (including route clearance, pre-lay works, install, post-lay burial, cable protection = 150 days • Dimension: 46 km length at 10 m width and 3 km at 50m width (49 km total length); • Area of seabed disturbed via cable installation: 650,000 m^2; • Area of potential sandwave clearance 150,000 m^2. Landfall • Footprint of potential placement of anchor/shallow barge deployment: 1,000 m^2; • Area of temporary floatation pit: 7,200 m^2; • Area of works associated with disturbance from open cut trenching: 6,354 m^2 **Total Area of Temporary Habitat Disturbance: 1,354,504 m^2 (1.35 km^2)**	This represents the maximum extent of temporary habitat disturbance throughout the construction phase, and hence the greatest disturbance of habitat over this period. Open cut trenching is the contingency option at the landfall and represents worst-case. HDD is the preferred option. Therefore, disturbance from open cut trenching is assessed here.

9.6.2.3 Through the various stages of the construction phase of the Project, there will be possible temporary disturbance for benthic communities within the Study Area. Under the worst case scenario this has been estimated to total 1,354,504 m^2 (1.35 km^2) from the installation of the array and offshore export cable (by trenching, jetting, burial etc); installation of drag embedment anchors; placement of barge and vessels; and sandwave levelling (Table 9.19).

9.6.2.4 At the landfall, standard mitigation Horizontal Directional Drill (HDD) is the preferred option, however, as a worst-case scenario open cut trenching as contingency may be required. The area of works at the landfall ECC is 6,500 m^2 for open cut trenching which includes the footprint of all its associated installation activities. A maximum corridor width of 10 m over a length of 650 m will be affected, of which 3 m will be subject to direct disturbance, i.e. the trench itself, and the remaining 7 m (3.5 m either side of the main trench) affected by temporary storage of side-cast materials/vehicle access.

9.6.2.5 Of this 6,500 m^2, 6,354 m^2 comprises sedimentary habitat which will be subject to temporary habitat disturbance. The remaining 146 m^2 comprises hard, rocky substrate. This impact is assessed separately under Section 9.6.3 'Operational Phase' as long-term habitat loss.

9.6.2.6 The total area of the near-field Study Area is 93.18 km^2 and including the far-field, the overall Study Area is 1,319.17 km^2. Therefore, the worst-case construction scenario design would result in the temporary disturbance of 1.45% of habitats, if only considering the near-field; and 0.10% of the entire Study Area (including far-field).The construction period is expected to run over an 18 month period; however, disturbance at any one location within the Study Area will not be continuous during this period, and will be short-term, as each construction activity requires a limited number of days for completion (Table 9.19).

9.6.2.7 **VER A: (KP0-1**) The infralittoral (splash zone) habitats of the upper shore, fringing the intertidal area of the landfall, are limited in extent but represent features of Section 7 maritime cliff and slopes and, as such, are of medium value. However, no further assessment is made on this VER due to both its limited extent, and its distribution across the landfall in relation to planned works for either the HDD, or open cut trenching option and therefore, will not be assessed further in this chapter.

9.6.2.8 **VER B, C, D, E and F (Annex I reef) (KP0 - KP1):** This combination of VER groups comprises the extensive areas of littoral and infralittoral rock of the intertidal and shallow sublittoral zone of the Study Area. The dominant VERs overall are VER B and VER C, which are, respectively, high and moderate exposed bedrock, and boulders. This VER group also contains VER E and F which are areas exhibiting 'features of littoral rock' (e.g. rock pools) (Volume 2, Figure 9.12b).

9.6.2.9 These rocky habitats are all deemed to represent Annex I rocky reef and with features of Section 7/OSPAR intertidal under boulder communities with a single sea cave (Annex I sea cave) recorded at the southern end of West Angle Bay, and this was also associated with VER group F ('intertidal ephemeral seaweeds on disturbed littoral rock'), indicating possible disturbance from freshwater influence or sand scour. Due to the combination of FOCI these VER groups represent, all are assigned a high value.

9.6.2.10 As standard mitigation, HDD is the preferred option at the landfall, with open cut trenching as contingency only. For the worst case design scenario of open cut trenching during construction (worst case 10 m width of overall works), this will occur across the infralittoral and littoral area, over 3 months, covering an area of 6,500 m^2 (0.007 km^2) and a temporary footprint from anchors of nearshore barges of 1,000 m^2 (0.001 km^2) and temporary flotation pit of 7,200 m^2 (0.007 km^2).

9.6.2.11 The extent of intertidal Annex I reef at the landfall of West Angle Bay, as mapped during the baseline surveys is 84,000 m^2 (0.084 km^2). However, with the potential route options and micro siting of the offshore export cable across the shore (e.g. avoiding rocky substratum including rock pools as far as possible), it is predicted that only 276 m^2 (0.00028 km^2) of the ECC and its associated intertidal works may overlap this feature, which is 0.003% of the extent of Annex I intertidal reef within the SAC itself.

9.6.2.12 Across the shallow subtidal area of West Angle Bay, Annex I bedrock reef was mapped, forming an extension of the intertidal rocky reef feature. As a worst case scenario of open cut trenching, it is calculated that 0.0005 km^2 of this shallow water reef will interact with temporary disturbance associated with this type of installation works during construction, and of the 433.15 km^2 of subtidal reef extent in the SAC, this represents only 0.0001% of this feature.

9.6.2.13 In consideration of the localised area and duration of works across the landfall, and the expected limited interaction with these receptor VER group(s), that themselves form part of an extensive Annex I intertidal and subtidal reef feature within the SAC, a low magnitude of impact is assessed.

9.6.2.14 These moderately to exposed rocky habitats at West Angle Bay generally support low diversity species assemblages, resilient to natural physical pressures. Across the intertidal zone, encrusting species are common, indicative of wave exposed communities, with fucoid canopies in less exposed areas. In the shallow subtidal area sand (scour) tolerant species are present. The low shore and shallow water rocky areas are a complex of A3.21 ('kelp and red seaweeds on moderately exposed sublittoral rock') (Volume 2, Figure 9.9) and the broad biotope A3.12 ('Sediment-affected or disturbed kelp and seaweed communities').

9.6.2.15 Within A3.12 (A3.125) opportunistic algae characterise the shallow rocky habitats, where rapid growth is important in the frequently sand scoured disturbed areas. Despite a high resilience to abrasion that may directly or indirectly occur during installation on the seabed or from anchoring, these biotope(s) have a low resistance and high sensitivity to changes to a different habitat type, which may occur during any local sediment disposal. The sensitivity of VER A-F to expected temporary disturbance from installation activities is overall assessed as medium.

9.6.2.16 In summary, in terms of temporary habitat disturbance during the construction phase, the low magnitude of the impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect, which is not significant in EIA terms.

9.6.2.17 **VER G and H (Annex I reef) (KP1 - KP4):** The subtidal rocky habitats of the Study Area were concentrated around the nearshore area of the ECC and were comprised mainly of VER group G (high energy circalittoral rock) and group H (moderate energy circalittoral rock). These were all assessed to represent Subtidal Annex I rocky reef (Volume 3, Figure 9.12) and, as such, are considered to be of high value. Habitat disturbance arising during installation (anchoring and barge deployments etc) will be overall highly localised, and predominantly occurring between KP0 – KP1, but with some occurring seaward of this.

9.6.2.18 Annex I subtidal reef within the SAC is predicted to cover an area of approximately 433.15 km^2 overall, and that 3.04 km^2 (0.7%) of this overlapped the near-field Study Area, and 0.37 km^2 (0.09%) overlapped the ECC itself (assuming a 10 m width of temporary habitat disturbance) (Lle Geo-Portal, 2021). However, following the ground truthing baseline surveys (Volume 3, Technical Appendix 9.2: Environmental Baseline Report), this overlap was found to be much lower, with only 0.96 km^2 (0.22%) overlapping the near-field Study Area within the SAC. Furthermore, with the cable purposefully routing (10 m wide ECC) through the approximately 100 m wide Row's Rocks channel, to minimise spatial overlap between the reef biotopes and the cable installation footprint, no direct overlap is expected between the reef and the Project during construction.

9.6.2.19 The construction works are planned to avoid these rocky habitats in the nearshore areas; however, some localised disturbance could potentially occur during ploughing of nearby sediment, potentially scouring adjacent rocky habitats. As a result of the expected limited impact and extent of pressures on Annex I reef habitats, a low magnitude of impact is assessed.

9.6.2.20 A4.1 high energy biotopes were predominantly present, representing subtidal Annex I reef, with the biotope A4.131 ('bryozoan turf and erect sponges on tide-swept circalittoral rock') being the dominant habitat recorded on the western side of the ECC in the Study Area. Due to its proximity to the coast and entrance to Milford Haven, natural disturbances from strong tidal currents and wave action are expected. If, during construction, disturbed and displaced sediment is indirectly deposited on these adjacent substratum then the associated communities are unlikely to recover from this physical change in habitat. However, if direct disturbance occurs through abrasion from anchoring of subsea equipment and indirect disturbance through increased scour, then some resilience may be exhibited (Readman, 2016). In consideration of the receptor(s) response to expected physical disturbance of the seabed during the construction, a medium sensitivity is assigned.

9.6.2.21 In summary, in terms of temporary habitat disturbance, the low magnitude of the impact combined with the medium sensitivity of the receptor results in **minor adverse** effect, which is not significant in EIA terms.

9.6.2.22 **VER I (KP0 - KP21)**: The coarser sediments of VER group I are represented predominantly by A5.143 ('*Protodorvillea kefersteini* and other polychaetes in impoverished circalittoral mixed gravelly sand') overall, where this biotope is extensive through Row's Rocks, and at the entrance to Milford Haven, and are of low value (Volume 2, Figure 9.8a). VER I is a dominant sediment habitat across the nearshore ECC and reflects the widespread regional extent of this seabed habitat (Volume 2, Figure 9.3). In consideration of the wide distribution of this VER group within the near-field Study Area, the extensive distribution of coarse sediments available within the far-field and wider region, and the relatively limited scale of impacts during construction, the magnitude of impact has been assessed as low.

9.6.2.23 A5.143 generally supports an impoverished community, and so the sensitivity of these sediments to construction activities will be important to determine recovery of the associated community. The strong currents and wave action of the nearshore region of the Study Area, means these habitats are already subject to natural physical disturbances and sediment movement and have a low sensitivity to them. Any habitat structure change through removal or disturbance, can recover quickly, but with deposition of finer sediments into a disturbed area as the transport of gravels will be limited (Tillin, 2016b). In consideration of the dynamic nature of sediments of VER I, resilient to physical disturbance but with a low resilience to change in habitat structure, an overall low sensitivity is assessed.

9.6.2.24 In summary, in terms of temporary habitat disturbance, the low magnitude of the impact combined with the low sensitivity of the receptor results in a **minor adverse** effect, which is not significant in EIA terms.

9.6.2.25 **VER J (KP0 and KP18-19)**: In the upper shore area of the landfall at West Angle Bay there are discrete bands of coarser sediments which are judged to be not representative of Annex I mudflats and sandflats. Therefore, they are assessed as being of negligible value in these intertidal areas. Along the ECC, discrete areas have also been mapped (KP18-KP19). As such. no further assessment is made on this VER group, due to its value and limited extent and location with the Study Area.

9.6.2.26 **VER K (Annex I mudflat and sandflats) (KP0 - KP1):** In the intertidal areas of the landfall at West Angle Bay there is a large expanse of fine sands and muddy sands, grouped as VER group K. All of this area (and the VER) is deemed to represent Annex I intertidal mudflats and sandflats, and is, therefore, of high value. The total area of this feature at the intertidal area, as mapped from the baseline surveys, is 0.058 km^2 (Volume 3, Technical Appendix 9.2: Environmental Baseline Report). With a worst case design scenario of a 10 m wide area where open-cut trench works will be undertaken, 0.003 km^2 of this VER will be subject to a short-term and temporary disturbance associated with the works. This temporary disturbance will only occur across 0.02% of the total extent of this feature within the SAC (19 km^2) and it is expected that it will not result in any localised permanent changes to this habitat and, thus, the overall will not adversely affect the status of this Annex I feature. In consideration of the scale of works across this designated feature (limited frequency and duration) and extent of this habitat available, the magnitude of impact has been assessed as low.

9.6.2.27 The predominant biotope mapped for VER K was A2.2 ('littoral sand and muddy sand') (Volume 2, Figure 9.9) and within A2.2, A2.231 ('polychaetes in littoral fine sand') was recorded across the lower to mid shores. This biotope comprises a community of mobile and opportunistic species, resilient to physical disturbances on and within the sediments, with a high recoverability rate expected; a medium sensitivity to removal of substrate, and low sensitivity to penetration and abrasion. In consideration of the adaptability of the VER to localised disturbances, but with responses to larger changes (e.g. removal), an overall low sensitivity of this receptor is assessed.

9.6.2.28 In summary, in terms of temporary habitat disturbance, the low magnitude of the impact combined with the low sensitivity of the receptor results in a **minor adverse** effect, which is not significant in EIA terms

9.6.2.29 **VER L (KP0 - KP43 and array area):** The biotopes represented by VER L are the dominant habitats within the array area (and 1 km buffer), the offshore areas of the ECC, and the landfall at West Angle Bay. This VER is defined as medium value as it is likely to represent Section 7 subtidal sands and gravels. The dominance of sandier substrates across the Study Area is also reflected in the regional extent of this seabed habitat (Volume 2, Figure 9.3), that shows extensive areas of offshore circalittoral sand. In consideration of the wide distribution of this VER group within the Study Area, the extensive distribution of circalittoral sands within the region, and the relatively limited scale of impacts during construction, the magnitude of impact has been assessed as low.

9.6.2.30 Biotopes that comprise the dominant VER group L are A5.25, A5.25, and A5.351, and A5.251 ('*Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand'), with A5.251 one of the most commonly mapped within the group. This benthic community comprises species that have opportunistic life histories with quick reproductive cycles (e.g., small polychaetes), and so recovery times may be expected to be short when compared with longer lived species that are also found in these sediments (e.g. larger bivalves).

9.6.2.31 Due to its wide distribution across the Study Area this receptor group will naturally be the main receptor subject to physical disturbances, including the key disturbance source of sandwave levelling. Following dredging in sediments within this biotope, abundances of opportunist species have been shown to recover within months (review by Tillin, 2016). The echinoderms *E. pusillus* and juveniles of *A. filiformis* characterise sediments in the offshore array area of the Study Area (Table 9.13).

9.6.2.32 Due to *A. filiformis* would be susceptible to mortality following any localised loss of substrate during construction, however recoverability is considered moderate and, if injury is caused, regeneration can occur. This species, and other mobile burrowing infauna, may not be sensitive to displacement of substrate during piling and cable laying, as they can burrow and migrate, to right themselves within the sediments (Hill and Watson, 2008).

9.6.2.33 Overall, Tillin (2016a) assessed the habitats and supported assemblages of A5.25 as having a medium sensitivity to changes to removal of sediments (e.g., during sandwave clearance and trenching), however, a low sensitivity to both abrasion or penetration of the seabed (e.g, anchoring or barge activities in the shallow areas of the landfall). As such, and in consideration of a community that will comprise both longer lived species and opportunists, an overall medium sensitivity has been assessed.

9.6.2.34 In summary, in terms of temporary habitat disturbance, the low magnitude of impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect, which is not significant in EIA terms.

9.6.2.35 **VER I and L (including Annex I sandbanks) (KP6.5 – KP17.5):** At discrete locations along the ECC, broader biotopes of VER group L (A5.25), along with VER group I that comprised coarser sediments (A5.14), overlapped with two areas resembling sandbanks. One was deemed to meet the criteria of designated features under Annex I, as this feature forms part of the Turbot Bank (Volume 2, Figure 9.11).

9.6.2.36 Total overlap of the near-field Study Area with Turbot Bank was 0.34 km^2 within the SAC, and 1.23 km^2 outside the SAC boundary. The far-field Study Area overlaps all of the Turbot Bank, along with part of the sandbank at St Gowan Shoals, southeast, and further along the coast (see Volume 2, Figure 9.4a).

9.6.2.37 It is important to note that sandwave levelling is not proposed within the SAC, only cable installation via conventional plough/trenching tool. For areas where sandwave levelling is not predicted to be required, the width of temporary habitat disturbance via cable/anchor installation is 10 m, compared to the 50 m width of disturbance in levelling areas. See Volume 3, Figure 13a-d for locations of sandwave levelling

9.6.2.38 Within the near-field Study Area, within the SAC boundary, the worst case construction footprint of the ECC route (10m width), overlaps with only 0.008 km^2 of Turbot Bank (inside the SAC). Outside of the SAC, discrete sandwave levelling may be required at Turbot Bank, between KP8.1-KP8.3, (approximately 200 m^2 length, maximum width of 50 m), however, most of the direct disturbance outside of the SAC will be limited to 10 m widths across Turbot Bank, through standard cable burial. As a worst case, assuming a 50 m wide corridor across the entire length, this represents a total potential area of disturbance outside of 0.14 km^2 of Turbot Bank, outside the SAC.

9.6.2.39 The total area of Turbot Bank is 24.05 km^2 (19.1 km^2 inside the SAC and 4.95 km^2 outside). Therefore, as a worst case, 0.15 km^2 (0.008 km^2 + 0.14 km^2), or 0.62% of Turbot Bank will be temporarily disturbed from the installation works.

9.6.2.40 In relation to the total area of all sandbank features within the SAC (51.59 km^2), the 0.008 km^2 interaction from habitat disturbance at Turbot Bank represents 0.015% of this designated site feature that will be temporarily disturbed during construction. In relation to the total area of sandbank features both within the SAC and outside the SAC (80.39 km^2), the worst-case of 0.15 km^2 disturbance, represents only 0.18% of this feature that will be temporarily disturbed during construction.

9.6.2.41 Therefore, in consideration of the extent of this designated feature (both within and outside of the SAC), the availability of similar sediments outside of the near-field Study Area, and the scale of impacts during construction, the magnitude of impact has been assessed as low.

9.6.2.42 The Turbot Bank sandbank is exposed to natural disturbances from wave action and the faunal communities supported in these sandy and coarse sediments will be characteristic of moderately strong tidal conditions and, potentially, adapted to physical disturbances (Greenlink, 2019). The infaunal communities of these features will, in part, mirror those mobile species in other sandy sediments of the Study Area for the extensive areas of VER groups L and I that overlap with sandbank features. Grab samples across the two sandbanks recorded a community including the small echinoderm *Echinocyamus pusillus* bivalves *Goodallia triangularis* and *Spisula* spp.*,* and the cat worm *Nephtys cirrosa,* and other polychaetes including *Glycera* sp. and *Ophelia* sp..

9.6.2.43 Resident species such as the bivalve *Spisula* spp. will be intolerant to any loss of habitat; however, if displaced during movement of sediments during cable installation, it will be able to burrow back down rapidly to seek suitable conditions (Sabatini, 2007). *N. cirrosa*, has high reproductive capacities and widespread larval dispersal stage and, therefore, recoverability of a population within physically disturbed sediments will be high (Ashley, 2016). Although *Glycera* worms have a single breeding period and a slow growth rate, populations can recover through migration, persisting in disturbed sediments through their burrowing abilities (Tillin*,* 2016a). As such, and in consideration of a community that will comprise both longer lived species and opportunists, an overall medium sensitivity has been assessed for this receptor.

9.6.2.44 In summary, in terms of temporary habitat disturbance, the low magnitude of impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

9.6.2.45 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Table 9.20 – Summary of Impact Assessment

VER group	Sensitivity	Magnitude	Signficance	Additional Mitigation	Residual Impact
Temporary disturbance of habitat					
B, C, D, E, F (Annex I)	Medium	Low	Minor adverse	None required	Minor adverse
G, H (Annex I)	Medium	Low	Minor adverse		
I	Low	Low	Minor adverse		
K (Annex I)	Low	Low	Minor adverse		
L	Medium	Low	Minor adverse		
I & L (including Annex I)	Medium	Low	Minor adverse		

Temporary Increases in Suspended Sediments/Smothering

9.6.2.46 The following is supported through information presented in Chapter 6: Marine and Coastal Processes and, where relevant, reference to its associated Volume 3, Technical Appendix 6.1: Marine and Coastal Processes Assessment Technical Report.

9.6.2.47 Table 9.21 summarises the realistic worst case scenario for temporary increase in suspended sediments and smothering of benthic habitats and species during the construction phase of the Project.

Table 9.21 - Summary of increased SSC Plume and Deposition Values

Realistic Worst Case Scenario	Justification
Maximum overall offshore construction duration = 8 months • *Maximum plume extent* (spring tides, tidal excursion from the activity): 10 km array area; 14 -15 km middle of the ECC; 18 - 19 km nearshore; 5-8 km within Milford Haven. • *Within <50 m of activity:* SSC in order of thousands to hundreds of thousands of mg/l, reducing rapidly with time and distance to order of hundreds or tens of mg/l. • *For low height of release from seabed:* SSC unlikely to exceed 150 mg/l beyond approx. 5 m for gravels, 30 m for coarse sand, 90 m for medium sand, and ~250 to 300 m for finer sands. The time required for redeposition of sands and gravels following resuspension is in the order of seconds to a few minutes. • *Sediment released at the water surface:* SSC unlikely to be >150 mg/l beyond ~100 m away for gravels, ~500 m for coarse sand, ~1.5 to 2 km for medium sand, ~5 km for finer sands. • *Sands and gravels release at the water surface:* settles, in the order of a few minutes to 1.5 hours. • *Finer sediment release at the surface:* <to 50 mg/l, up to approx. 2 km downstream; decreasing to 1-5 mg/l within 1 - 3 days through progressive dilution and dispersion. • At low height of release from the seabed, sediments deposit within a distance proportional to their grainsize/settling rate. Approx. 5 m for gravels, 30 m for coarse sand, 90 m for medium sand, and ~250 to 300 m for finer sands. Time required for redeposition of sands and gravels following low height disturbance is in the order of seconds to a few minutes. • *Deposition - Sands and gravels*: may cause measurable thickness of sediment deposition within the above described distances for SSC. However, can depend on other variables. Thicknesses >0.05 m and 0.3 m are possible, but the maximum area of effect is inherently limited by the finite volume of sediment disturbed. • *Deposition – Fines:* expected to become widely dispersed (order of several kms) and so will not resettle with measurable thickness locally.	The parameters outlined here represent the worst case scenarios for both plume dispersion and sediment deposition. The ECC and array area will comprise a range of sediment particle sizes, resulting in lower average sediment distribution ranges, suspension times, maximum SSCs and deposition thickness across the overall area. Sandwave levelling is not proposed within the SAC. See Volume 3, Technical Appendix 6.1: Marine and Coastal Processes Assessment Technical Report for full details.

9.6.2.48 Throughout the construction phase of the Project there will be disturbance of seabed sediments. This disturbance can release sediment into the water column as a plume, increasing SSC and thus increasing water turbidity, until the plume becomes dispersed by tidal currents and the sediments re-settle on the seabed. This may cause indirect impacts of smothering of benthic habitats and species, altering local habitats and affecting feeding capabilities and other eco physiological functions.

9.6.2.49 The principal causes of this disturbance during construction will be:

- Sandwave levelling with dredge and/or use of Mass Flow Excavator (MFE) and subsequent return of this material to the water column at/near the sea surface;
- Installation of anchors;
- Drilling fluid release associated with HDD at landfall;
- Drill arisings released from drilling for pile anchors;
- Pre-lay cable trenching or cable installation using a plough, jetting or MFE tool(s);
- Flotation pit construction near landfall; and
- Material released from open cut trenching at landfall (contingency).

9.6.2.50 The scale of this impact will vary spatially across the Study Area, and will depend upon the installation activity, the sediment type and local hydrodynamic and geomorphological processes.

9.6.2.51 The potential changes caused by longer duration activities that can cause sediment disturbance (such as drilling, dredging, overspill, cable trenching, or cable installation using a jetting or MFE tool) were assessed and the release of drilling fluids (bentonite and drill cuttings) at HDD cut out sites also quantified. These are summarised below and see Volume 3, Technical Appendix 6.1: Marine and Coastal Processes Technical Report for full results.

9.6.2.52 Seabed habitats across the array area, ECC and intertidal areas comprise a mosaic of rocky platforms, boulders and sediments. Sediments were generally dominated by sands, but with variable proportions of muds and gravels also present. Due to mixed composition of different size fractions of gravel, sand and mud, most of the area comprises poorly to very poorly sorted sediments. Plume dispersion in areas of fine sediment has the potential to extend up to 2 km downstream of activities at SSCs of 50 mg/l, when released at the water's surface. A plume of this type may take up to 3 days to reduce to background concentrations.

9.6.2.53 In areas of coarser sediment, plume extent and SSC levels are likely to be significantly reduced, with concentrations of 150 mg/l expected at distances of 500 m and 100 m for coarse sands and gravels, respectively.

9.6.2.54 During periods of peak tidal flow, plume dispersion may be significant. Under mean spring conditions the maximum tidal excursion for the Project is approximately:

- 10 km around the array area;
- 14-15 km around the middle of the ECC (approximately KP20);
- 18-19 km in the nearshore approaches to Milford Haven (approximately KP10); and
- 4 km within Milford Haven.

9.6.2.55 However, even though some mobilised sediment may travel the distances stated, the actual SSC within the water column will rapidly reduce to near background levels within a few km from point of release. See Volume 2, Figure 6.4 for spatial variation in modelled tidal excursion and current speeds.

9.6.2.56 For sediment disturbance occurring closer to the seabed, during activities such as cable installation and cable burial, sediment dispersal is likely to be significantly reduced compared with when sediment is released higher in the water column. At the point of release, SSC may be very high (hundreds of thousands of mg/l), however, at a release height of 3 m above the seabed, SSC is unlikely to exceed 150 mg/l beyond approx. 5 m for gravels, 30 m for coarse sand, 90 m for medium sand, and ~250 to 300 m for finer sands.

9.6.2.57 In areas of exposed rock platform or particularly large sediment size, no sediment plume would be expected as particle suspension cannot occur. In areas nearer to shore, background concentrations of SSC are likely to be high due to natural events including wave and surge effects, particular during periods of stormy weather.

9.6.2.58 Sediment deposition thickness of 0.3 m may be possible, where sediment is both coarse and released close to the seabed. However, in scenarios where plumes of fine sediments are dispersed over a large area, resettlement will not occur with measurable thickness. Where deposition of sediment does occur, winnowing will likely cause dispersal of these sediments within a few tidal cycles.

9.6.2.59 Potential sediment deposition on FOCI Section 7 and OSPAR habitats and species present in the far-field Study Area (see Volume 2, Figure 9.5) had also been modelled, where due to the wide dispersion of fine sediments, no measurable thickness of sediment accumulation for maërl beds, seagrass beds saltmarsh, blue mussel beds, and sheltered muddy gravels, was predicted.

9.6.2.60 In summary, where sediment plume dispersal is far reaching (surface release of fines), SSC increase, and sediment deposition is likely to be negligible. In cases where sediment deposition is significant (close to seabed release of coarse sediments) the extent is likely to be limited to within the cable corridor, and likely to exist over a limited temporal period.

9.6.2.61 Potential changes in SSC, can also occur from release of drilling fluid (containing bentonite (non-toxic) and drill cuttings) at HDD punch-out near the landfall. Release of drilling fluid can result in a localised but temporary plume of elevated SSC (bentonite clay). The HDD exit point is located near to the main channel and, thus, the majority of plume will be advected away. The bentonite in the drilling fluid is expected to remain in suspension for a minimum of a few hours or days and will disperse widely prior to settlement. As such, bentonite is not expected to accumulate in any measurable thickness. Any accumulated material that does form close to the HDD exit pit, is expected to be reworked and redistributed over time by wave and tidal action.

9.6.2.62 For assessment of impact on each VER group(s), the magnitude of effect will be assessed separately, to account for variation in sediment types, tidal excursions and benthic habitats within different parts of the Study Area, where these impacts may arise.

9.6.2.63 **VER B, C, D, E, F (Annex I reef) (KP0 - KP1):** These VER receptor group(s) comprise the extensive areas of littoral and infralittoral rock of the intertidal and shallow sublittoral zone of the Study Area and represent features of Annex I reef. These receptors are of high value and are assessed together.

9.6.2.64 Within the intertidal and shallow subtidal areas, the worst case design scenario in terms of benthic effects is open cut trenching across the infralittoral and littoral area. This activity may take up to 3 months and will involve anchoring or shallow barge deployments in the shallow subtidal area of West Angle Bay. This represents the contingency option to the primary solution at landfall, of HDD. With HDD, impacts on rocky habitats will be avoided.

9.6.2.65 West Angle Bay is a moderate to exposed environment, characterised by high and moderate energy rock. The adjacent sediments of the intertidal are dominated by littoral sand and muddy sand (A2.2). The shallow subtidal area is dominated by mobile, clean, fine sands, with some coarse sands recorded around the central area leading up to shore. It is expected that any sediment disturbed from trenching and anchoring in the shallow waters will mostly comprise finer particles. Therefore, dispersion of this sediment is expected to be widespread, with subsequent sediment deposition being minimal (in terms of thickness). Coarser sand particles may be limited to a 500 m dispersion distance from source of impact, however due to the dynamic nature of the site, regular sediment movement of fine and coarse particles is experienced at the site.

9.6.2.66 West Angle Bay is situated on the southern side of the entrance of Milford Haven where the sediment movement is generally ebb dominated, so any resuspended sediments will predominantly be transported downstream away from the Haven and not brought back to site. In consideration of the extent and duration of impact and the environmental conditions a low magnitude of impact is assessed.

9.6.2.67 These moderately to highly exposed rocky habitats generally support low species assemblages, resilient to natural physical pressures. The intertidal A1.113 biotope, characterised by barnacles and limpets is one of the key habitats identified across the intertidal bedrock. Any increases in suspended finer sediments in the water column that may arise from trenching, may locally enhance food supply for filter feeders such as barnacles, but if levels are too high, this can impair feeding mechanisms by clogging gills and reducing light for photosynthesis of algae. However, with regular tidal inundations, these settled sediments are likely to rapidly remobilise and alleviate any longer-term effects of smothering (Tillin and Hill, 2016).

9.6.2.68 The subtidal rocky biotopes are characterised by sand tolerant species. These communities are sensitive to a change in habitat (e.g., rock to sedimentary), but in such a dynamic environment it is expected that any deposited sediments will be repeatedly resuspended and transported away. As such, these sand tolerant species have a low sensitivity to change in SSC and are not sensitive to smothering from deposition of suspended sediments. Overall, these VER group(s) B-F are assessed to be of low sensitivity.

9.6.2.69 In summary, in terms of increased SSC and deposition, the low magnitude of impact combined with the low sensitivity of the receptor results in a **minor adverse** effect on VERs B-F, which is not significant in EIA terms.

9.6.2.70 **VER G and H (Annex I reef) (KP1 - KP4):** Moderate and high energy subtidal rocky habitats are concentrated around the nearshore part of the Study Area (KP1-KP4) and all represent Annex I rocky reef (Volume 2, Figure 9.12). These are considered to be of high value.

9.6.2.71 In this nearshore region, the offshore export cable will be installed in Row's Rocks channel, a sediment filled channel that lies within the areas of VER G and H. With the proposed offshore export cable corridor routed through Row's Rocks channel, and standard mitigation options of micro-siting, rocky habitats will be avoided. However, any disturbance of sediments within this channel (defined as VER I), will lead to mobilisation of sediment which may, in turn, disperse and settle on the adjacent VERs G and H.

9.6.2.72 The marine and coastal processes assessment has predicted that the spatial extent of an increased SSC plume in this area will be limited to a few tens of metres at the time of disturbance, with concentrations increasing to very high values (>thousands of mg/l). However, the duration of increased SSC will only last as long as the active disturbance period, plus 30 minutes post event. Sediment deposition will comprise both sands and gravels, with local thickness of tens of centimetres, potentially reaching 0.30 m.

9.6.2.73 With respect to the potential deposition of sediment on habitats within VER G and H, whilst this is predicted to arise, the effect will be relatively localised and also temporary in nature. These areas of habitat (0.96 km^2 recorded within the near-field Study Area) also form part of a wider and extensive area of similar subtidal reef, within the Pembrokeshire Marine SAC (433.15 km^2), and so will not adversely affect the status of this FOCI. As such, the magnitude of impact is assessed as low.

9.6.2.74 Within these two VERs, the high energy biotope A4.131 ('bryozoan turf and erect sponges on tide-swept circalittoral rock' was the dominant habitat). Bryozoans such as *Flustra foliacea* exhibit a degree of tolerance to increased SSC in the water column, and this biotope is also insensitive to light or heavy smothering and siltation. Burial in excess of 30 cm may cause mortality; however, in strong hydrodynamic conditions it can be expected that most deposited material will be removed quickly (Readman, 2016). These two VERs are, therefore, assessed to be of low sensitivity overall.

9.6.2.75 In summary, in terms of increased SSC and deposition, the low magnitude of impact combined with the low sensitivity of the receptor results in a **minor adverse** effect on VER G-H, which is not significant in EIA terms.

9.6.2.76 **VER I (KP0 - KP21):** Coarser sediments of VER I are represented predominantly by biotope A5.143 in the nearshore region, including within Row's Rocks channel. The habitats in this VER are assessed as having low value. VER I is a dominant sediment habitat across the nearshore ECC and reflects the widespread extent of this seabed habitat across this region. In consideration of the distribution of this VER group, the scale of impacts during construction, the magnitude of impact has been assessed as low.

9.6.2.77 A5.143 generally supports an impoverished community, and so the sensitivity of these sediments to construction activities will be important in determining recovery of the associated community. Any resuspension of sediments within these habitats is unlikely to be of significance, as any gravels that settle out locally will not negatively impact key species, compared with sand deposition. If sands are remobilised in other areas of the Project, it is unlikely that any deposition across VER I will result in thick layers of sands, due the strong local hydrodynamics of the area. Species supported in these impoverished sediments are resilient to increases in SCC and associated turbidity, with little or no sensitivity to this pressure. The overall sensitivity of VER group I is, therefore, assessed as low.

9.6.2.78 In summary, in terms of increased SSC and deposition, the low magnitude of impact combined with the low sensitivity of the receptor results in a **minor adverse** effect on VER I, which is not significant in EIA terms.

9.6.2.79 **VER K (Annex I mudflats and sandflats) (KP0 - KP1):** VER Group K represents the sedimentary intertidal areas of the landfall at West Angle Bay, where there is a large expanse of fine sands and muddy sands. These are deemed to represent Annex I intertidal mudflats and sandflats and thus, are of high value. As a worst case scenario, temporary disturbance of the seabed from open cut trenching is only going to occur across 0.002% of the total extent of this Annex I habitat within the Pembrokeshire Marine SAC. These sediments of the intertidal are the main sediment facies of the shallow subtidal area at West Angle Bay, and similar sediments exist nearby. Thus, it is unlikely that the proposed cable installation/open cut trenching works will result in deposition of different sediment types across VER K.

9.6.2.80 In consideration of the scale of works (limited frequency and duration) across this VER, and the extent of this habitat available across the wider region, the magnitude of impact has been assessed as low.

9.6.2.81 A2.231 ('polychaetes in littoral fine sand') was recorded across the lower to mid shore. This biotope comprises a community of species resilient to physical disturbances from smothering/siltation and increases in SSC, with little or no sensitivity to such pressures. If deposition occurs, it may reduce available preferred habitat, but following a tidal cycle such sediments will likely be re-suspended and dispersed. In consideration of the adaptability of the VER to resuspended sediments and deposition, an overall low sensitivity is assessed.

9.6.2.82 In summary, in terms of increased SSC and deposition, the low magnitude of impact combined with the low sensitivity of the receptor results in a **minor adverse** effect on VER K, which is not significant in EIA terms.

9.6.2.83 **VER L (KP0 - KP43):** VER group L is dominant within the array area (and the 1 km buffer) and the offshore areas of the ECC (KP21-KP49). This VER is represented by the biotope complex A5.251 (fine sand) and A5.3051 (sandy mud) which are defined as medium value. The habitats in this VER will be subject to increased SSC and deposition via a combination of activities included sandwave levelling, cable ploughing/trenching, and installation of anchors/mooring lines (including potential drilled piling).

9.6.2.84 Across the array area, dispersion of any of these finer suspended sediments from disturbances caused by cable installation activities and anchor deployments (worst case up to 10 m width) may reach up to 10 km; and across the ECC may reach 15 km under peak tidal flow conditions (also see Volume 2, Figure 6.4 and Chapter 6: Marine and Coastal Processes). There are extensive areas of this habitat type across this far-field Study Area and wider region, and the scale of impact on this receptor is also minimised as it is expected similar sediments will be re-deposited following disturbance. Overall, the magnitude of impact is assessed as low.

9.6.2.85 Sandwave levelling will be undertaken across the ECC, and excluding those areas where this VER group represents the Annex I sandbank Turbot Bank, it will interact with this habitat at a limited number of locations:

- KP14.9 - KP15.5 (approximately 400 m^2);
- KP29.1 - KP30.4 (approximately 600 m^2); and
- KP35.6 - KP46.3 (within the array area) (approximately 500 m^2).

9.6.2.86 Sandwave levelling will involve sediment being redistributed locally (via MFE), and/or the material dredged (<50 m corridor) and disposed into the water column nearby. It may be expected that this will generate a higher SSC than standard cable installation and from anchor deployments during the construction phase, as greater volumes of sediment will be disturbed at a given time. Due to the relatively localised area of direct effect, and the expected distribution of these finer sediments that comprise VER L, it may be expected that impacts of SSC and smothering will be spatially limited to a localised area and,as such, the overall magnitude of impact is assessed as low.

9.6.2.87 Burrowers are naturally adapted to resist the deposition of additional fine sediments. The representative biotopes A5.251 and A5.351 of VER group L, comprise species capable of surviving short periods of burial under deposited sediment, with recovery possible providing sediments are not too cohesive, and local hydrodynamic conditions can naturally redistribute these settled layers. Increased SSC may clog feeding apparatus of *A. filiformis* and *K. bidentata;* however, both species have the adaptability to switch between filter feeding and deposit feeding under changing environmental conditions. Overall, this receptor group is assessed as medium sensitivity.

9.6.2.88 In summary, in terms of increased SSC and deposition, the low magnitude of impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect on VER L, which is not significant in EIA terms.

9.6.2.89 **VER I and L (including Annex I sandbanks) (KP6.5 – KP17.5):** The broader biotopes of VER group L (A5.25), form a mosaic with VER group I that comprised coarser sediments (A5.14), across sections KP6.5-KP17.5. Along this length, two localised areas of sandbanks are represented, of which one is assessed as Annex I (Turbot Bank), and thus overall identified as high value (Volume 2, Figure 9.11). As a worst case, the ECC itself (a maximum width of 10 m), overlaps with only 0.008 km^2 of Turbot Bank within the SAC, and 0.14 km^2 outside of it. The 50 m worst case width is based on maximum width of sandwave clearance; however, within the SAC boundary, no sandwave clearance is proposed and, thus, this spatial overlap and degree of disturbance over Turbot Bank will be restricted to cable lay and burial (see Volume 2, Figure 13c).

9.6.2.90 It has been predicted that for the area in close proximity to Turbot Bank, the spatial extent of any short-term increased SSC plume will only be within a few tens of metres, will last no more than 1 hour after the end of activity, and have no long term or permanent change in SSC values. Fine sediment is also unlikely to redeposit in measurable thickness (see also Chapter 6: Marine and Coastal Processes, Table 6.18 and Volume 2, Figure 6.25). In consideration of the extent of this designated feature (within the SAC), and the scale of impacts, the magnitude of impact has been assessed as low.

9.6.2.91 Sandbanks can be dynamic features and assessed to have capacity to recover from perturbations such as from sediment deposition. It is expected that the faunal communities within these features, are resilient to a degree of increased SSC and smothering and can reorientate and right themselves through their burrowing capabilities. Turbot Bank biotopes mapped within the near-field Study Area comprised a mosaic of A5.25 and A5.14 biotopes of VER Group L and I, respectively (Volume 2, Figure 9.7b and Figure 9.12a). A5.25 (VER Group L) was the dominant habitat mapped across the bank within the SAC and is assessed as having a high resilience and low sensitivity to changes in suspended solids and smothering, or changes in low siltation rates, as bivalves and polychaetes are able to survive limited periods under sediment. However, if heavy siltation rates occur, then sensitivity to smothering of these communities is assessed as medium, as some mortality may occur (Tillin, 2016a). In consideration of the short term disturbance but sensitivity of the biotope components to localised smothering, an overall medium sensitivity has been assessed.

9.6.2.92 In summary, in terms of increased SSC and deposition, the low magnitude of impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect on VER I and L, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

9.6.2.93 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Table 9.22 - Summary of Impact Assessment

VER group	Sensitivity	Magnitude	Signficance	Additional Mitigation	Residual Impact
Temporary increases in suspended solids/smothering					
B, C, D, E, F (Annex I)	Low	Low	Minor adverse	None required	Minor Adverse
G, H (Annex I)	Low	Low	Minor adverse		
I	Low	Low	Minor adverse		
K (Annex I)	Low	Low	Minor adverse		
L	Medium	Low	Minor adverse		
I & L (Annex I)	Medium	Low	Minor adverse		

Introduction of INNS

9.6.2.94 The following is supported through information presented in Volume 3, Technical Appendix 9.4: Invasive Non-Native Species Plan.

9.6.2.95 Table 9.23 summarises the realistic worst case scenario for introduction of INNS during the construction phase of the Project.

Table 9.23 - Summary of Key INNS Values

Realistic Worst Case Scenario	Justification
Maximum overall offshore construction duration = 8 months Total area available for colonisation: **499,478 m^2 (0.50 km^2)** Semi-submersible floating platforms: 74,260 m^2 Suction pile anchors: 4,020 m^2 Driven pile anchors: 996 m^2 Mooring lines: 61,784 m^2 Mooring line clumps: 14,000 m^2 Array cables: 2,827 m^2 Array cable protection: 126,048 m^2 ECC cable protection: 215,208 m^2 HDD exit cable protection: 335 m^2	This represents the maximum surface area that may be available for colonisation by INNS on the marine infrastructure. Worst case dimensions have been used for all calculations and for a full breakdown see Volume 3, Technical Appendix 9.4: INNS Plan**.**

9.6.2.96 During the construction phase of the Project there will be a potential increased risk of introduction of INNS into the area, via the increased vessel activity required for installation. Milford Haven is the third largest port in the UK, with a busy shipping channel and high recreational boat use and, as such, it is likely that INNS resident in, or newly introduced into these waters, can be further introduced into the benthic environment of the Study Area. The INNS slipper limpet *C. fornicata* has been resident in Milford Haven since the 1950s and there is concern that with its high larval dispersal potential, project activities during construction/installation could allow recruitment of juveniles (Greenlink, 2019). For a full list of potential INNS species that could be introduced see Volume 3, Technical Appendix 9.4: INNS Plan.

9.6.2.97 This assessment will be combined for all benthic receptors identified from the near-field Study Area (combined VERs etc) as they may all be expected to have a general negative sensitivity to this potential effect. Vessels and equipment associated with the Project may introduce INNS to waters within and around the Study Area. Each of these has been individually risk assessed in Volume 3, Technical Appendix 9.4: INNS Plan, Table 2. From this assessment, it was determined that there is an overall greater risk of introductions via vessels, semi-submersible floating platforms and any areas of export cable protection, compared with areas of array cable protection and/or the mooring lines located within the array area.

9.6.2.98 The main construction phase activities associated with the Project that were identified as potentially introducing or spreading INNS are:

- Installation of anthropogenic structures (i.e., semi-submersible floating platforms and associated mooring system, and array and export cables and associated cable protection) in the Study Area;
- Fabrication and towing of the semi-submersible floating platforms; and
- Using vessels from outside the local area.

9.6.2.99 It is difficult to predict the exact nature of potential impacts from the introduction of INNS as associated sensitivities of, and interactions with, existing benthic communities/species can be complex and habitat/species/community specific. Project embedded standard mitigation measures includes the development of an INNS Plan that will provide a framework for management of biosecurity issues and invasive species for the Project duration and will include compliance with relevant guidance regarding ballast water. These measures will reduce the overall risk of introduction.

9.6.2.100 As such, the overall magnitude of impact is assessed as negligible, and as a precaution, the sensitivity of the benthic receptors as medium. Therefore, in terms of potential introduction of INNS, the negligible magnitude of the effect combined with the medium sensitivity of the receptor results in a **minor adverse** effect, which is not significant in EIA terms.

Additional Mitigation and Residual Effect:

9.6.2.101 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Accidental Release of Pollutants from Vessels and/during Installation

9.6.2.102 The following is supported through information presented in Chapter 7: Marine Seabed and Water Quality and Chapter 16: Shipping and Navigation.

9.6.2.103 Table 9.24 summarises the realistic worst case scenario for key vessel activity during the construction phase of the Project, in relation to potential risk of accidental release of pollutants.

Table 9.24 - Summary of Key Vessel Details (Potential Pollution)

Realistic Worst Case Scenario	Justification
Maximum overall offshore construction duration = 8 months Vessel presence = 6 at any one time (for semi-submersible floating platform installation)	Corresponds to the maximum number of vessels that would realistically be expected to be operating simultaneously. Each vessel contributes additional risk of accidental pollution incident**.**

9.6.2.104 The presence of numerous works vessels in and around the Project area (array area and ECC), introduces risk of pollution from leaks or spills of fuels carried on-board these vessels, in addition to the potential for pollution by construction materials accidently released into the marine environment. It is anticipated that up to six vessels will be present at any one time within the array area for semi-submersible floating platform installation works. Overall offshore construction may take up to 8 months to complete.

9.6.2.105 The majority of structures used in construction operations will have been manufactured and pre-assembled on land. However, the use of plant and associated machinery for final installation introduces risk of chemical contamination. In addition, there is potential for chemicals found as standard on marine vessels, such as oils or antifouling paints, to be accidently released into the marine environment.

9.6.2.106 Best practice techniques will be employed at all times to reduce the risk of pollution events as far as possible. A Marine Pollution Contingency Plan (MPCP) will be produced and agreed with stakeholders post consent. This document will detail mitigation measures that will be employed to prevent pollution events, and the emergency response procedure and notifications that would be required should an incident occur.

9.6.2.107 The strong hydrodynamic regime across the Study Area, means that should an accidental release occur, the substance should rapidly disperse, and thus minimise its potential impact on the benthic environment. In consideration of the standard mitigation and adoption of best practice, the magnitude of impact is assessed as negligible.

9.6.2.108 The response of a species to accidental release of pollutants will be dependent upon its sensitivity in combination with its physical environment. For example, fresh oil spills occurring directly on intertidal areas are likely to have a greater impact than if spilled subtidally, where oil sinks and becomes emulsified and adsorbed onto particles (Stamp, 2014). To assess for different sensitivities across the benthic receptors, the VER groups have been broadly grouped and relevant key sensitivities to pollutants (e.g. oil) summarised in Table 9.25.

9.6.2.109 The subtidal benthic receptors are less likely to be susceptible to accidental release of pollutants than intertidal receptors. However, in consideration of potential responses to such an impact, overall, the receptor(s) as assessed as medium sensitivity.

9.6.2.110 In summary, in terms of potential pollution from vessels during construction, the negligible magnitude of impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect on all VERs, which is not significant in EIA terms.

Table 9.25 - Summary of Sensitivity of VERs to Pollution Events from Vessels *High value When Overlapping Areas of Assessed Sandbanks

VER group(s)	Area/ Habitat	Value	MarESA Sensitivity Review	Reference
B, C, D E, F (Annex I)	Landfall Littoral and infralittoral rock	High	Intertidal barnacles and limpets have some resistant to hydrocarbons (unless fresh oil). Red algae is sensitive to chemical contamination including hydrocarbons. Kelps (*Laminaria* sp. etc) can be protected by their mucilaginous layers when exposed to pollutants.	Tillin and Hill (2016): A1.113; Stamp (2014); A3.125
G, H (Annex I)	ECC nearshore Circalittoral rock	High	Filter feeding epifauna are sensitive to hydrocarbons, with impacts on breeding of bryozoan *Alcyonidium* spp. Bryozoans are sensitive to synthetic compounds.	Readman (2016): A4.131
I and L (can contain Annex I)	ECC offshore Array area Circalittoral sediments	High*	Echinoderm and bivalves exhibit general sensitivity to pollutants such as hydrocarbons. Polychaetes (*Nephtys* sp. etc) may be tolerant.	Tilin (2016a): A5.251; De-Bastos and Hill (2016): A5.351.
K (Annex I)	Landfall Littoral sediments	High	Infaunal polychaetes and amphipods affected by hydrocarbons, deterioration of sand communities	Ashley (2016): A2.231

Additional Mitigation and Residual Effect

9.6.2.111 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above

Accidental Release of Contaminants Through Disturbance of the Seabed

9.6.2.112 The following is supported through information presented in Chapter 6: Marine and Coastal Processes and Chapter 7: Marine Seabed and Water Quality.

9.6.2.113 Table 9.26 summarises the realistic worst case scenario for potential release of contaminants via disturbance of sediments during the construction phase of the Project.

Table 9.26 - Summary of Potential Release of Contaminants from Disturbance

Realistic Worst Case Scenario	Justification
As per parameters for Temporary Habitat Disturbance Total Area of Temporary Habitat Disturbance: **1,354,504 m^2 (1.35 km^2)**	Corresponds to (a combination of) the greatest amount of material disturbed, the largest dimensions of trenching, the greatest depth of seabed lowering/levelling, and the greatest geographical extent of the impact.

9.6.2.114 The installation works, such as those for the array cables and the offshore export cable using a plough, jetting or MFE tool(s) at the seabed, or cutting tools within the intertidal environment, will lead to sediment disturbance, and under the worst case scenario, 1.35 km^2 of seabed is predicted to be disturbed during installation. The associated sediment disturbance has the potential to re-mobilise sediments that contain chemical contaminants.

9.6.2.115 However, subtidal sediment contamination across the array area and ECC is low (see Section 9.5 for baseline information).

9.6.2.116 Arsenic was the most common contaminant, being recorded in excess of Cefas Action Level 1. Nickel, chromium and cadmium were also recorded in excess of this threshold. These limited number of instances where concentrations of metals exceeded standard thresholds also showed no clear pattern of distribution. It is apparent that where contamination does occur, it is not concentrated in broad regions, but intermittently distributed throughout the footprint of the Project (see Chapter 7: Marine Seabed and Water Quality for full details).

9.6.2.117 Only one of these elevated results was recorded for a sample station close to the historic dredge disposal site, last in use in 1994. The absence of elevated contaminant levels in sediments collected close to the historic Milford Haven disposal site indicates that there is a low risk that cable installation through this area will result in mobilisation of contaminated sediments. In view of the analysis results for sediments collected in this area, works within the footprint of the historic disposal ground are not considered to pose an increased risk to benthic fauna, relative to other areas of the ECC.

9.6.2.118 Hydrocarbons were generally recorded at relatively low concentrations, and with a general pattern of higher concentrations at nearshore stations compared with offshore stations, which is most likely due to the proximity to coastal urban settings. Threshold Effect Level (TEL) was exceeded at a limited number of stations for hydrocarbon compounds, but no samples exceeded Probable Effect Level (PEL), which means concentrations were below levels in which adverse effects may be expected in a wider range of organisms.

9.6.2.119 In consideration of the duration and scale of disturbance during Project construction, and the low concentrations and distribution of contaminants (heavy metals, hydrocarbons etc) across the Study Area, the magnitude of impact is assessed as negligible.

9.6.2.120 To assess for different sensitivities across the benthic receptors, the VER sedimentary groups have been broadly grouped and relevant key sensitivities to organo-metal contamination are summarised in Table 9.27. The sedimentary benthic receptors are overall assessed as medium sensitivity.

9.6.2.121 In summary, in terms of potential remobilisation of contaminated sediments affecting benthic receptors, the negligible magnitude of impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect on all VERs, which is not significant in EIA terms.

Table 9.27 - Summary of Sensitivity of Benthic Receptors to Accidental Release of Sediments via Seabed Disturbance * when in areas assessed as Annex I sandbanks

VER group(s)	Area/ Habitat	Value	MarESA Sensitivity Review	Reference
I and L (can contain Annex I)	ECC offshore Array area Circalittoral sediments	High*	Sub-lethal levels may cause behavioural and physiological responses in bivalves (disruption in burrowing, valve closure, inhibition of filtration rate). Echinoderms will bioaccumulate heavy metals and are intolerant. Polychaetes are often tolerant.	Tilin (2016a): A5.251; De-Bastos and Hill (2016): A5.351.
K (Annex I)	Landfall Littoral sediments	High	Will not accumulate in substratum to the same extent as in muds, but with long term exposure, bioaccumulation can occur.	Ashley (2016): A2.231

Additional Mitigation and Residual Effect

9.6.2.122 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

9.6.3 Operational Phase

9.6.3.1 Under the operational (and maintenance) phase, the following potential impacts have been assessed:

- Long term habitat loss (direct);
- Temporary habitat disturbance from cable repair and remediation and catenary swept areas (direct and indirect);
- Temporary increases in suspended sediments/smothering (indirect);
- Colonisation of infrastructure by INNS (indirect);
- Colonisation of infrastructure by marine organisms (non INNS) (indirect);
- Protection of benthic habitats from fishing restrictions (indirect);
- Accidental release of pollutants from vessels (direct);
- Accidental release of pollutants through disturbance of the sediment (indirect);
- EMF and heat from electrical cables (direct); and

- Long term changes to physical processes (indirect).

Long-Term Habitat Loss from Infrastructure

9.6.3.2 The following is supported through information presented in Chapter 4: Proposed Development Description and Chapter 6: Marine and Coastal Processes.

9.6.3.3 Table 9.28 summarises the realistic worst case scenario for Long-Term habitat loss during the construction phase of the Project.

Table 9.28 Summary of Long-Term Habitat Loss Values

Realistic Worst Case Scenario	**Justification**
Maximum operational period: 25 years Array Area: area of seabed impacted • Array cables and or/protection: 11,000 m^2; • Array cable stabilisation: 56,250 m^2; • Area loss under drilling piles 175 m^2; • Area loss under deposited sediments from piling 11,340 km^2; • Navigational aids/environmental monitoring moorings: 500 m^2; Offshore Export Cable: area impacted • Cable protection: 83,380 m^2 (up to 7,580 m of rock berm with 11 m base width) – inclusive of Greenlink cable crossing cable protection (rock and mattress): Landfall • HDD exit protection areas: 210 m^2. • Open cut trenching 146 m^2 (permanent habitat loss*****) **Total: 163,001 m^2 (0.16km^2)**	Area of long-term habitat loss is predicted from maximum worst case areas impacted by (or under footprint) of infrastructure and mooring line clumps. Cable stabilisation is a reduced area of protection (cable with no protection is 6.75 km^2). *****If HDD at the landfall is not possible, then the contingency option of open cut-trenching (3m wide x 650 m length = 1,950 m^2) will result in permanent habitat loss where it interacts with the rocky shallow sublittoral habitats (by 146 m^2). Open cut trenching otherwise causes temporary habitat disturbance as sediments will be backfilled, and this has been assessed under construction impacts, see Section 9.6.2.

9.6.3.4 Following the initial placement of project infrastructure on the seabed during construction, there will be a direct long-term (25 years) habitat loss for benthic communities within the Study Area during the O&M phase. Under the worst case scenario this has been estimated to be 163,001 m^2 (0.16 $km^{2)}$ (Table 9.28).

9.6.3.5 This area of long-term loss also includes the contingency of open cut trenching at the landfall should HDD not be possible. The trenching is expected to impact an area of 1,950 m^2 (0.00195 km^2), some within the shallow infralittoral and the majority in the intertidal zone. However, of this 0.00195 km^2 subject to trenching, the majority (93 %) will occur on sedimentary habitats, where sediments can be backfilled during trenching activities, i.e. resulting in a temporary habitat disturbance. Thus, the actual permanent loss will be restricted to where the trenching interacts with rocky habitats. Therefore, it is this component of the open cut trenching that will be assessed alongside long-term habitat loss via project infrastructure in this section.

9.6.3.6 The total area of the near-field benthic Study Area is 93.18 km^2, and inclusive of the far-field, is 1,319.18 km^2. Therefore, the worst-case design scenario would result in the long-term and permanent habitat loss of 0.17% of the benthic habitats within the near-field Study Area and, inclusive of the far-field Study Area, 0.012% of the benthic habitats.

9.6.3.7 Standard Mitigation (listed in Section 9.4.9.1) includes the initial site selection to avoid sensitive habitats, a detailed pre-consent cable route refinement designed to avoid sensitive habitats, and HDD proposed at landfall with open cut trenching only included as contingency. With the range of habitats, receptors and FOCI present across the site, separate assessments will be made against each VER group(s), and in consideration of the relevant standard mitigation measures that will reduce the potential magnitude of impact.

9.6.3.8 Table 9.29 summarises the VER group(s) and their approximate extent within the Study Area, and whether habitat loss may occur from placement of infrastructure (see also Volume 2, Figure 9.12 and Figure 13a-d).

Table 9.29 Total area (km^2) of Key Valued Ecological Receptor Groups(s) within the near-field Study Area, and expected interaction with infrastructure and long-term habitat loss

VER	Habitat Type	Annex I/ Section 7/OSPAR	Study Area / approx. KP	VER Extent (km^2)	Long-Term Habitat Loss Expected
B, C D, E, F,	Littoral and infralittoral rock	Reef (rocky) Under-boulder communities Sea cave (feature of Reefs)	West Angle Bay Landfall KP0 – KP1	0.11	Yes – Worst-case scenario of permanent loss from the contingency of open cut trenching at approximately KP0.4
G and H	Circalittoral rock	Reef (rocky)	Nearshore ECC KP2 – KP4	0.91	No
I	Circalittoral coarse sediments	Subtidal mixed muddy sediments	Nearshore ECC KP1.5 – KP6.	4.93	Yes – via cable protection proposed between KP4.6 – KP6.6
K	Littoral fine sands/muddy sands	Intertidal mudflats and sandflats	Landfall KP0 – KP1	0.08	No

VER	Habitat Type	Annex I/ Section 7/OSPAR	Study Area / approx. KP	VER Extent (km^2)	Long-Term Habitat Loss Expected
L	Circalittoral fine sands/muddy sands	Subtidal sands and gravels	Offshore ECC (KP21- KP43) and array area	Total: 83.24 43.5 (array area) 29.69 (1km buffer) 10.05 (KP21-KP43)	Array Area Yes - via; array cable protection/ stabilisation; suction piles; clump weights on mooring lines ECC Yes – via cable protection in discrete sections between KP35.5 – KP46.3
I and L	(as above)	Sandbanks Subtidal sands and gravels	Nearshore ECC I: KP0-KP6 I: KP6-KP21 L: KP0-KP21	Total 7.71 (L: 2.78) (I: 4.939)	Yes – ECC via cable protection in discrete areas (including Greenlink cable crossing at approximately KP 7.25). Landfall via cable protection at HDD exit points, at approximately KP0.6

9.6.3.9 **VER B, C, D, E, F (Annex I reef) (KP0 - KP1):** These littoral and shallow water infralittoral rocky substrates of West Angle Bay all comprise Annex I rocky reefs and are, therefore, of high value. Their total combined area is 0.11 km^2.

9.6.3.10 As stated above, HDD is the preferred option at the landfall, with open cut trenching as contingency only. For the worst case design scenario of open cut trenching during construction, 1,950 m^2 (0.00195 km^2) will occur at the landfall, but this will only result in an interaction with, and permanent habitat loss of, 0.000146 km^2 (146 m^2) of shallow sublittoral rocky Annex I reef, where it forms an extension of the intertidal reef feature (Volume 2, Figure 9.13e). Therefore, as a worst case scenario of open cut trenching, it is calculated that 0.000146 km^2 (146 m^2) of VER C shallow water reef area will interact with the 3 m open cut trench, resulting in permanent habitat loss, and of the 433.15 km^2 of subtidal reef extent in the SAC, this represents only 0.00003% of this subtidal feature.

9.6.3.11 In consideration of the highly localised area impacted from open cut trenching, and the expected limited spatial interaction with Annex I reef, that though themselves form part of an extensive feature within the SAC, a negligible magnitude of impact is assessed.

9.6.3.12 VER group C represents moderately exposed littoral and infralittoral rocky habitats. The biotopes of the shallow waters belonging to this VER group that are likely to interact with open-cut trenching will represent A3.21 (kelp and red seaweeds on moderately exposed infralittoral rock); Table 9.18; Volume 2, Figure 9.12b). Any habitat loss of these shallow sublittoral rocky substrates from open cut trenching will be permanent and non-reversable, and the common biotopes present all have no resistance, very low resilience and high sensitivity to this impact. These shallow habitats at West Angle Bay generally support low diversity species assemblages, and no species of conservation importance was identified during the snorkel surveys (Volume 3, Technical Appendix 9.1: Integrated report (Geophys and Habitat Assessment), Annex I: West Angle Shallow Subtidal Snorkel Survey Report). The sensitivity of VER C to permanent habitat loss from installation is overall assessed as high.

9.6.3.13 In summary, in terms of permanent habitat loss of VER Group A-F (Annex I reef), from open cut trenching, the negligible magnitude of the impact on overall habitat (and Annex I reef) combined with the high sensitivity of the receptor (VER C) results in a **minor adverse** effect, which is not significant in EIA terms.

9.6.3.14 As the contingency option of open cut trenching is limited to the landfall shallow waters of the landfall, and permanent habitat loss will only impact VER C, no further assessments are required for other VER groups for permanent habitat loss in the Study Area.

9.6.3.15 **VER G and H (Annex I reef) (KP1 - KP4):** The sublittoral rocky habitats of the nearshore ECC (around Row's Rocks channel) are deemed to be representative of Annex I reef and are, therefore, of high value, covering an area of approximately 0.96 km^2 within the near-field Study Area. No rock protection is proposed in the sedimentary areas through Row's Rock channel, and no long-term habitat loss is expected on the adjacent rocky habitats. The expected limited spatial impact and extent of pressures on Annex I reef habitats means that a negligible magnitude of impact is assessed.

9.6.3.16 Recruitment of epifaunal bryozoans on new substrates can occur only if breeding colonies remain nearby. For *F. foliacea*, strong water movements, as occur in the Study Area, can improve dispersal and colonisation capacity into an area of habitat lost and replaced with rock protection. Rates of recolonisation can also vary between taxonomic groups, with rapid recovery of colonial sea squirts (ascidians), and longer term increases in coverage of sponges (Porifera) and sea anemones (Actiniaria) (Readman, 2016). As assessed for the rocky VER groups B-F, the receptor group(s) are assessed as medium sensitivity.

9.6.3.17 In summary, in terms of long-term loss of habitat, the negligible magnitude of impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect on VERs G and H, which is not significant in EIA terms.

9.6.3.18 **VER I (KP1.5 - KP6):** The coarser sediments of VER group I (e.g., A5.143, circalittoral mixed gravelly sand) run across the ECC, towards the approximately 100 m wide channel through Row's Rocks, and into the entrance to Milford Haven. This habitat covers an approximate area within the near-field Study Area of 493,263.52 m^2 (4.93 km^2) (excluding areas of Annex I Turbot Bank) and is of low value. No protection is anticipated to be placed within Row's Rocks channel, but placement may be required at its southern entrance, and at discrete locations along the ECC, thus locally impacting VER group I between KP4.7-KP6.6 (approximately 1,246.7 m^2).

9.6.3.19 This estimated protection potentially impacts 0.001 km^2 of VER I which is, as a worst-case, 0.03% of this habitat within the near-field Study Area. VER I comprises a sediment type that is regionally dominant across the nearshore (circalittoral coarse sands) (Volume 2, Figure 9.3). In consideration of the distribution of this VER group within the Study Area, the extensive distribution of coarse sediments available within the region, and the likely scale of impacts from the placement of rock protection, the magnitude of impact has been assessed as negligible.

9.6.3.20 A5.143 (of VER group I) generally supports an impoverished community, and so it will be the sensitivity of these sediments to habitat loss from cable protection activities that will be important to determine. It is assessed that these receptors will have a high sensitivity to a physical change to another seabed type, as this will effectively be permanent (Tillin, 2016b), However, as this potential change would occur across a small scale, the biotope(s), and thus the VER, is resilient to such a localised change in its habitat structure and an overall medium sensitivity is assessed.

9.6.3.21 In summary, in terms of long-term loss of habitat, the negligible magnitude of impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect on VER I which is not significant in EIA terms.

9.6.3.22 **VER K (Annex I mudflats and sandflats) (KP0-KP1):** VER group K is the large expanse of intertidal fine sands and muddy sands at West Angle Bay. These are deemed to represent Annex I intertidal mudflats and sandflats, and are, therefore, of high value. No long-term habitat loss is expected for this receptor as no permanent rock protection is planned across the intertidal shore. As such, **no impact** is predicted.

9.6.3.23 **VER L (KP0-1 and KP21- KP43 and array area):** VER L is the dominant subtidal receptor group in the Study Area at West Angle Bay, across the array area (and the 1km buffer), and the offshore areas of the ECC (see also Volume 2, Figure 9.12). It has been assigned a medium value.

9.6.3.24 There will be little disturbance or loss from HDD at the landfall at West Angle Bay, as the preferred route option is through the centre of the landfall, under the intertidal flats. However, rock protection will be required for the HDD exit points in the shallow sublittoral, across the area represented by VER L, where 4 tonne rock bags with a 25 mm mesh size are proposed to be used. The rock berm will be 21 m length x 5 m width, covering an area of 210 m^2 (0.00021 km^2), that can result in long-term habitat loss underneath its footprint (Table 9.28; Volume 2, Figure 9.12 and 9.13a). The total extent of VER L within the near-field study area is 86.01 km^2, and thus this long-term habitat loss of 0.00021 km^2 represents only 0.0002% of this receptor group. In consideration of the nature and scale of loss that will occur, the magnitude of impact is assessed as negligible.

9.6.3.25 The long-term loss of habitat under the footprint of the HDD exit protection, is a localised loss of shallow sublittoral sediments, replaced with hard substrate. However, this may offer colonisation potential for other species observed colonising the exposed bedrock in the bay (e.g. kelps, sponges and red algae; Volume 3, Technical Appendix 9.1). The biotopes that will be directly impacted by the rock protection, will be the mobile sandy sediments supporting generally sparse infaunal species (e.g. A5.25/A5.231) (Volume 2, Figure 9.8a; Volume 3, Technical Appendix 9.1). These habitats will initially be sensitive to a loss from sedimentary substrates within the footprint of the protection (Tillin, 2016c). However, it is expected that overtime sediments will accumulate across areas of the berm and localised colonisation may occur. The receptor group(s) are therefore assessed as medium sensitivity.

9.6.3.26 In summary, in terms of long-term loss of habitat from the HDD rock protection, the negligible magnitude of impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect on VER L, which is not significant in EIA terms.

9.6.3.27 Under a worst case design scenario, 0.08 km^2 (0.11% of the habitat within the array area and 1 km buffer) will be subject to long-term loss within the Study Area (Table 9.28). The dominance of sandy benthic habitats across the wider Study Area reflects the regional extent of this seabed habitat (Volume 2, Figure 9.3), which shows extensive areas of offshore circalittoral sand. In consideration of the wide distribution of this VER group within the Study Area, the extensive distribution of circalittoral sands within the region, and the scale of impact within the Study Area, the magnitude of impact has been assessed as **negligible**, which is not significant in EIA terms.

9.6.3.28 The biotope communities of VER L within the array area and the ECC will be subject to localised long-term losses in habitat, following a change from sedimentary to artificial hard substrates (via the inter array cable stabilisation and/or protection; the mooring line clump weights and/or suction piles). This receptor has a high sensitivity to a physical change to a hard seabed type, as communities are characterised by burrowing bivalves, polychaetes and echinoderm species, rather than epifaunal species.

9.6.3.29 High sensitivities of the receptor will be exhibited at local scales in the array area and ECC, where artificial hard protection is sited. However, the receptor may, overall, be resilient to a localised change in its habitat type and structure, where no overall change in biotope will be ascribed, and thus an overall medium sensitivity is assessed.

9.6.3.30 In summary, in terms of long-term loss of habitat within the array area from project infrastructure, the negligible magnitude of impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect on VER L, which is not significant in EIA terms.

9.6.3.31 **VER I and L (including Annex I sandbank) (KP6.5 – KP17.5):** Between approximately KP6.5 and KP21 of the ECC, VER L (A5.25) along with VER group I that comprises coarser sediments (A5.14), forms a mosaic of sediments (covering an area of 6.14 km^2) which overlaps with two areas of sandbanks. One of these is the Annex I Turbot Bank (KP6.5-KP10.5) and one which does not fully meet the criteria of Annex I but exhibits sandbank characteristics (KP15-KP18). As such, these separate areas are deemed to be of high value (see also Volume 2, Figure 9.12).

9.6.3.32 As a worst case, and for contingency, from KP4.6 seawards, an average of approximately 15% of the length of the ECC (KP4.6 to array area; 0 to 80% of individual sections) may require cable protection in areas where no/shallow burial is predicted. Some of this cable protection is predicted to be required within the boundary of the SAC. However, based on current data from within the ECC, it is expected that an overall limited extent of cable protection will be required within the Turbot Bank feature, as the area between KP6.6 - KP7.2 is assessed as having suitable depth of sediment for cable burial (see Volume 2, Figure 9.13b-d for cable protection locations and percentage coverage across each section of protection).

9.6.3.33 An area of protection is required at KP7.2-KP7.3 (0.0021 km^2) for the Greenlink Interconnector cable crossing, which overlaps the far western extent of the Turbot Bank sandbank feature within the SAC boundary, however, through the embedded mitigation measures of detailed cable routing options, this avoids the main morphological features of the sandbank itself where it is approximately 2 km to the west of the crest of the bank.

9.6.3.34 The total area of Turbot bank is 24.05 km^2 (19.1 km^2 inside and 4.95 km^2 outside the SAC combined), and therefore, the potential long-term habitat loss from rock protection at the Greenlink crossing is only 0.0087% of the entire bank, and 0.011% of the feature inside the SAC itself. The proportion of all sandbank features within the SAC boundary (51.59 $km^{2)}$), this equates to a long-term loss of only 0.0041%,

9.6.3.35 For the 'potential' sandbank feature occurring between KP15-KP18, outside of the SAC rock protection is only estimated to be required for 20% of the segment between KP17.2-KP18 (Volume 2, Figure 13d).

9.6.3.36 With limited rock protection for Turbot Bank, the limited extent across the secondary feature, and that Annex I sandbanks overall form part of a wider network of sandbanks (51.59 km^2) in the SAC, the magnitude of impact has been assessed as low.

9.6.3.37 Receptors will be sensitive to a change in seabed type, with burrowing infaunal communities of sandbanks vulnerable to such changes as could occur from the initial placement of rock protection. The Turbot Bank sandbank is part of a dynamic system, often reworked by strong tidal currents (Greenlink, 2019) and over time, rock protection may become buried and any localised loss of the biotope would not be permanent. There is expected to be an initial period of sediment accumulation within and around the rock berm, accumulating within an order of a few weeks to a few months.

9.6.3.38 Following initial accumulation and development of a naturally stable slope and surface, sediment transport will continue over the berm at natural ambient rate and direction, with deposited substrates again locally available for lateral migration and recruitment by fauna. Initial pressures from habitat loss, may in time become reduced, and thus an overall medium sensitivity is assessed.

9.6.3.39 In summary, in terms of long term loss of habitat, the low magnitude of impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect on VERs Land I, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

9.6.3.40 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Table 9.30– Summary of Impact Assessment

VER group	Sensitivity	Magnitude	Signficance	Additional Mitigation	Residual Impact
Long-term loss of habitat from infrastructure					
G, H (Annex I)	Medium	Negligible	Minor Adverse	None Required	Minor Adverse
I	Medium	Negligible	Minor Adverse		
K (Annex I)	Not assessed for O&M.1				
L	Medium	Negligible	Minor Adverse		
I & L (Annex I)	Medium	Low	Minor Adverse		
Permanent loss of habitat from open cut trenching					
C (Annex I)	High	Negligable	Minor Adverse	None required	Minor adverse

Temporary Habitat Disturbance from Cable Repair and Remediation and Catenary Swept Areas

9.6.3.41 Table 9.31 summarises the realistic worst case scenario for temporary habitat disturbance during the cable repairs and remediation under operation and maintenance, and with consideration of swept catenary areas within the array area.

Table 9.31 – Summary of Realistic Worst Case Scenario for Temporary Habitat Disturbance

Realistic Worst Case Scenario	Justification
Operation period: 25 years ECC • 5 estimated repair events (export cable). • 1 km estimated cable repair length: • 250,000 m^2 total estimated export cable repair area • 600,000 m^2 total estimated export cable remediation event. Array area • 5 estimated repair events (array cables) • 1,505,250 m^2 estimated cable repair area • 1,303,194 m^2 m mooring line catenary swept area • 82,500 m^2 cable catenary swept area **Total: 3,740,944 m^2 (3.74 km^2)**	This represents the maximum extent of temporary habitat disturbance throughout repairs and remediation, and hence the greatest potential disturbance to benthic habitat over this period.

9.6.3.42 As with other offshore wind projects, there will be a requirement for planned and unplanned maintenance activities throughout the O&M phase of the Project. These activities may vary in nature, however the maintenance activities considered likely to cause temporary habitat disturbance impacts are export and array cable repairs and cable remediation (Table 9.31). It is expected that the nature of the repairs will cause a similar disturbance as those outlined for temporary disturbances of habitats during the construction phase (Section 9.6.2), just on a smaller spatial scale. As such, the impact assessment will mirror and summarise this assessment, but with consideration of differing scales between these two phases of works. The PDE assumes that there will be up to five repairs to array cables within the array area, up to five repairs to the offshore export cable within the ECC, and up to 12 cable remediation events.

9.6.3.43 Cable repair works, if required, will be primarily across the ECC and the array area (as listed in Table 9.31). However, if a fault develops in the length of cable in the trench, then a discrete repair event would be required. The magnitude of this potential impact is expected to be highly localised and limited in frequency and is assessed as negligible.

9.6.3.44 The movement of the catenary chains and cables within the array area may cause temporary disturbance of the seabed. With a catenary mooring system, at any time only a portion of the mooring chains will lay upon the seabed and the remaining portion is suspended in the water column. The amount of chain suspended at any time is in response to external forces (wind, wave and tides) and thus there will not be permanent contact on the seabed over the entire operational period. As such the total area of disturbed habitat caused by this process, of 1,303,194 m^2 (1.30 km^2) (Table 9.31), is a precautionary value.

9.6.3.45 Overall, the area of temporary habitat disturbance via these activities is predicted to occur across a 3,740,944 m^2 (3.74 km^2) area, over the 25 year operating period. The total area of the near-field Study Area is 93.18 km^2, therefore, the worst-case scenario would result in the temporary disturbance of 4.01% of the habitats within the application area and 0.28 % of the habitats in the far-field Study Area (total 1,319.18 km^2). Due to the low frequency of these repairs and remediation activities, and relatively limited spatial extent, the magnitude of impact on all associated receptors is assessed as low.

9.6.3.46 The MarLIN pressure factor relevant to this impact and used to inform this assessment is 'abrasion/disturbance' and 'penetration or disturbance', plus consideration of 'removal of substratum'. The sensitivities will remain the same as assessed for temporary habitat disturbances during construction (low to medium) for the relevant subtidal VER groups:

- VER B, C, D, E and F (Annex I reef);
- VER G and H (Annex I reef);
- VER I;
- VER L; and,
- VER I and L (Annex I sandbanks).

9.6.3.47 In summary, in terms of temporary habitat disturbance via O&M activities, the overall low magnitude of impact combined with the low to medium sensitivity of the receptors, results in a **minor adverse** effect on VERs L&I, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

9.6.3.48 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Table 9.32 – Summary of Impact Assessment

VER group	Sensitivity	Magnitude	Signficance	Additional Mitigation	Residual Impact
Temporary disturbance of habitat					
B, C, D,E,F (Annex I)	Medium	Negligible	Minor adverse	None required	Minor adverse
G, H (Annex I)	Medium	Negligible	Minor adverse		
I	Low	Negligible	Minor adverse		
K (Annex I)	Low	Negligible	Minor adverse		
L	Medium	Negligible	Minor adverse		
I & L (Annex I)	Medium	Negligible	Minor adverse		

Temporary Potential Increases in Suspended Sediments/Smothering via Cable Repairs/Remediation and Catenary Swept Disturbances

9.6.3.49 The following is supported through information presented in Chapter 6: Marine and Coastal Processes and where relevant reference to its associated Volume 3, Technical Appendix 6.1: Marine and Coastal Process Assessment Technical Report.

9.6.3.50 Table 9.33 summarises the expected sediment dispersion distances and deposition for different seabed sediments that maybe disturbed during the O&M phase.

Table 9.33 – Summary of Worst Case Scenario for Increased Suspended Sediments and Smothering

Realistic Worst Case Scenario	Justification
Operation period: 25 years Maximum value for disturbance in ECC and array from cable repairs/remediation, as listed above for Table 9.31) Values for dispersion and deposition • *Plume extent:* up to 10 km within the array area; 15 km in the centre of the ECC; 18-19 km nearshore; and 5-8 km within Milford Haven estuary. • *Within <50 m of the activity*: suspended sediment concentrations (SSC) will be in the order of thousands to hundreds of thousands of mg/l for short temporal and spatial extents. • *In fine (silt and mud) sediment environments*: SSC is expected to be up to 50 mg/l up to approximately 2 km downstream of the activity, decreasing to 1-5 mg/l within 1-3 days. • *In sand and gravels environments*: Works will have significantly lower impacts. • *Fine sediment deposition:* will not resettle with measurable changes to sediment thickness due to dispersion occurring over a wide area. • *Sand and gravel deposition:* may result in increases in sediment thickness >0.3 m.	The parameters outlined here represent the maximum values for disturbance through repair and maintenance during the Project lifespan, and worst case scenarios for both plume dispersion and sediment deposition. The ECC and array area will comprise a range of sediment sizes, resulting in lower average sediment distribution ranges, suspension times, maximum SSCs and deposition thickness across the overall area.

9.6.3.51 The PDE assumes that there will be up to five repairs to array cables anticipated in the array area, up to five repairs to the offshore export cable within the ECC, and up to 12 cable remediation events.

9.6.3.52 Offshore export cable repairs and/or remediation activities across the ECC and array area are expected to result in some localised seabed disturbance accompanied by temporary increases in SSC. It is expected that equipment similar to that used to install the offshore export cable will be used for cable repairs and/or cable remediation. Accordingly, the area of seabed impacted during the de-burial and removal of any area of export/array cable would be similar to (but no greater than) the area impacted during the installation of the same cables. The overall spatial extent of impact across the Study Area will be less than experienced in the construction phase, in consideration of the more limited scale of works required. These activities will also occur intermittently over the 25 year O&M phase, and for shorter durations than the main cable installation. As such the magnitude of impact is assessed as negligible.

9.6.3.53 Cable repair works, if required, will be primarily across the ECC and the array area (as listed in Table 9.31). However, if a fault develops in the length of cable in the intertidal trench, then a discrete repair event would be required and there may be a risk of increased in suspended sediments and subsequent smothering. The magnitude of this potential impact as is expected to be highly localised and limited in frequency and is assessed as negligible.

9.6.3.54 The movement of the catenary chains and cables within the array area may cause temporary disturbance of the seabed, thus increasing the suspension of sediments in the array area. With a catenary mooring system, at any time only a portion of the mooring chains will lay upon the seabed and the remaining portion is suspended in the water column. The fine sediments of the array area, if physically disturbed during the movement of the cables and chains, are expected to disperse a maximum distance of <10 km from source. However, as the sediments will comprise sands then this wide dispersion will dilute any impacts of increased SSC and there will be no measurable changes to sediment thickness. In consideration of this negligible deposition of resuspended sediment, but with the potential frequency of disturbance during the O&M phase, the magnitude of impact is assessed overall, as low.

9.6.3.55 The MarLIN pressure factor relevant to this impact and used to inform this assessment is ‘changes in suspended solids’ and ‘smothering and siltation’. The sensitivities will remain the same as assessed under for temporary disturbance of habitats during construction (low to medium) for the relevant subtidal VER groups:

- VER B, C, D, E and F (Annex I reef);
- VER G and H (Annex I reef);
- VER I;
- VER K;
- VER L; and
- VER I and L (Annex I sandbanks).

In summary, in terms of increased SSC and/or deposition via cable repairs/remediation and swept catenaries, the low to negligible magnitude of impact combined with the low to medium sensitivity of the receptor(s) results in a **minor adverse** effect on all VERs, which is not significant in EIA terms.

Table 9.34 - Summary of Impact Assessment.

VER group	Sensitivity	Magnitude	Signficance	Additional Mitigation	Residual Impact
Temporary increases in suspended solids/smothering					
B,C,D,E,F (Annex I)	Low	Negligible	Minor adverse	None required	Minor adverse
G, H (Annex I)	Low	Negligible	Minor adverse		
I	Low	Negligible	Minor adverse		

VER group	Sensitivity	Magnitude	Signficance	Additional Mitigation	Residual Impact
K (Annex I)	Low	Negligible	Minor adverse		
L	Medium	Low	Minor adverse		
I & L (Annex I)	Medium	Low	Minor adverse		

Additional Mitigation and Residual Effect

9.6.3.56 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Colonisation of Infrastructure by INNS

9.6.3.57 The following is supported through information presented in Volume 3, Technical Appendix 9.4: Invasive Non-Native Species Plan.

9.6.3.58 Table 9.35 summarises the parameter values relevant for potential risk of colonisation of installed infrastructure by INNS during the O&M phase.

Table 9.35 – Summary of Vessel Activity and Total Area of Infrastructure available for Colonisation by INNS

Realistic Worst Case Scenario	Justification
Operation period: 25 years Vessel presence Up to 6 x vessel visits per turbine, per year 2 weeks of vessels on site per cable repair/remediation event. 1 x major O&M campaign (tow back to port) each year. Area available for colonisation by INNS Total area: 499,478 m^2 (0.50 km^2)	Corresponds to the maximum number of vessels that would realistically be expected to be operating simultaneously. Each vessel contributes additional risk of accidental introduction of INNS. The area values represent the maximum surface area that may be available for colonisation by INNS on the installed marine infrastructure. Worst case dimensions have been used for all calculations; and for a full breakdown see Volume 3, Technical Appendix 9.4: INNS Plan.

9.6.3.59 In addition to the potential increased risk of introduction of INNS into the area during the construction phase and the O&M phase, there is also risk of colonisation by INNS. This may be via the installed marine infrastructure that provides suitable artificial habitat for settlement, and/or further risk of introductions to the area from vessels undertaking maintenance and operational activities. As for this construction phase effect, the assessment will be combined for all benthic receptors identified from the Study Area (combined VERs etc.).

9.6.3.60 The Project will be in operation for up to 25 years, and therefore, will provide a suitable timeframe for colonisation of these structures by INNS. With an expected shifting climatic baseline over time, it may also be expected that a greater number of southerly Lusitanian species will migrate into Welsh waters, extending their northerly range.

9.6.3.61 Offshore wind farms can act as 'stepping stones' for INNS, providing a network of substrates to exploit, in environments that otherwise would not be suitable for colonisation. It has been calculated that the total area available for potential colonisation by INNS on the installed marine infrastructure is 499,478 m^2 (0.50 km^2); with approximately 46% of this available from the ECC (and HDD exit) cable protection, 25% for array cable protection, and 15% for the semi-submersible floating platforms themselves. The remaining surfaces are provided by the anchors, mooring lines and clumps and unprotected array cables. The total area available for potential colonisation by INNS is 0.54% of the 93.18 km^2 near-field Study Area, and inclusive of the far-field, is 0.04%.

9.6.3.62 The risk of anthropogenic introductions of INNS into the area via O&M activities may, however, be limited, as vessel presence for O&M activities will be limited to up to 6 x vessel visits per turbine per year; up to 2 weeks of vessels on site for each cable repair/remediation event and, on average, 1 major tow back to port for major O&M work on the semi-submersible floating platforms.

9.6.3.63 It is difficult to predict potential impacts from the colonisation of INNS as associated sensitivities and interactions can be complex, and habitat and species/community specific. As such, the overall magnitude of impacts from is assessed as low, and sensitivity of the benthic receptors as medium.

9.6.3.64 In summary, in terms of potential colonisation by INNS in the O&M phase, the low magnitude of impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect on all VERs, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

9.6.3.65 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Colonisation of Infrastructure by Marine Organisms (non-INNS)

9.6.3.66 The following is supported through information presented in Volume 3, Technical Appendix 9.4: Invasive Non-Native Species Plan.

9.6.3.67 Table 9.36 summarises the total area of infrastructure available for colonisation during the O&M phase.

Table 9.36 - Summary of Total Area of Infrastructure Available for Colonisation by Non-INNS Marine Organisms

Realistic Worst Case Scenario	Justification
Maximum operational period: 25 years Area available for colonisation Total area: 499,478 m^2 (0.50 km^2)	This represents the maximum surface area that may be available for colonisation by marine species. Uses the same worst case dimensions as used for total areas available for INSS for colonisation. For a full breakdown see Volume 3, Technical Appendix 9.4: INNS Plan.

9.6.3.68 The introduction of hard artificial structures into the marine environment, will not only provide newly available substrates for INNS to colonise, but may also provide habitats for other species. This may have both positive and negative effects on adjacent benthic communities. Habitat complexity and biomass may be locally enhanced, and with scour protection acting as an artificial reef, attracting species such as large mobile decapods (Langhamer, 2012). However, assemblages associated with these structures may not necessarily be more diverse and may impact the structural functioning of adjacent communities. For the purpose of this assessment, the potential impact will be considered as, overall, beneficial.

9.6.3.69 It has been calculated that the total area available for potential colonisation on the installed marine infrastructure is 499,478 m^2 (0.50 km^2); with approximately 46% of this available from the ECC (and HDD exit) cable protection, 25% for array cable protection, and 15% for the semi-submersible floating platforms themselves. The remaining surfaces are provided by the anchors, mooring lines and clumps and unprotected array cables. The total area available for potential colonisation by species is 0.54% of the 93.18 km^2 nearshore Study Area; and inclusive of the far-field, is 0.04%.

9.6.3.70 The Project infrastructure will be in the environment for a period of up to 25 years, and as such colonisation may be expected to occur. However, the rate of colonisation will also be dependent on other factors, such as the position of the semi-submersible floating platforms and mooring lines in the water column, their orientation, and texture. Assemblages within the water column that are likely to settle on these structures may mirror typical 'pier piling' communities such as Mytilidae mussels, and with an intertidal zonation pattern as exhibited within these assemblages (review by Wilhelmsson and Malm, 2008).

9.6.3.71 The majority of the subtidal areas of the Study Area, and the region, is comprised of sedimentary habitats and, as such, potential beneficial effects from the establishment of a new distinct hard bottom community, would be highly localised around each installed structure. Therefore, the magnitude of the impacts of the introduced substrate on the existing communities is considered to be negligible.

9.6.3.72 As these structures may also include INNS, a cautionary medium sensitivity of all resident benthic VER groups has been applied.

9.6.3.73 In summary, the negligible magnitude of the effect combined with the medium sensitivity of the receptor results in the impact of colonisation of infrastructure by marine organisms (non INNS) to be considered as having **minor beneficial** effect and, therefore, not significant in EIA terms.

Additional Mitigation and Residual Effect

9.6.3.74 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Protection of Benthic Habitats from Fishing Restrictions

9.6.3.75 Table 9.37 summarises the extent of expected fishery restrictions that will be implemented across the array area during the O&M phase.

Table 9.37 – Summary of Fishing Restrictions

Realistic Worst Case Scenario	Justification
Operation period: 25 years Loss of access to fishing grounds due to long-term presence of Project infrastructure. Array area plus 1 km buffer: 103.5 km^2. Assumed that entire offshore export cable (inclusive of cable-protection) will be over-trawlable and that static gear could be set.	This represents the potential area currently used as fishing ground that will be made inaccessible as a result of the Project.

9.6.3.76 The following is supported through information presented in Chapter 15: Commercial Fisheries.

9.6.3.77 During the O&M period of up to 25 years, aside from the purpose of general navigation, it has been assumed that no commercial fishing activity will be permitted within the array area. Following consultation with local fishing organisations, an additional 1 nm buffer has also been added around the array area to represent the worst-case area (km^2) of lost fishing grounds.

9.6.3.78 At present, the array area is currently used by only a single commercial fisheries receptor (>12 m offshore mobile gear vessel) (see Chapter 15: Commercial Fisheries). However, it is currently unknown how regional fishing pressures may change during the Project's operational period, and if this restriction may be of greater significance. As such, the magnitude of this impact is assessed as low.

9.6.3.79 The main VER within the array area is VER L (circalittoral fine sands/muddy sands), which includes features of A5.251. This biotope will comprise opportunistic species (e.g. *Spisula solida* and small polychaetes) as well as longer lived larger individuals. VER Group L is assessed as having a medium sensitivity.

9.6.3.80 In summary, in terms of potential increased protection of benthic habitats from fishing restrictions during the O&M phase, the low magnitude of the impact combined with the medium sensitivity of the receptor results in a **minor beneficial** effect, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

9.6.3.81 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Accidental Release of Pollutants from Vessels and from WTGs

9.6.3.82 The following is supported through information presented in Chapter 7: Marine Seabed and Water Quality.

9.6.3.83 Table 9.38 summarises the parameters relevant for assessment of risk of accidental release of pollutants during the O&M phase.

Table 9.38 – Summary of Vessel Activity and WTG Generators for Worst Case Risk of accidental release of Pollutants

Realistic Worst Case Scenario	Justification
Operation period: 25 years Vessel presence Up to 6 x vessel visits per turbine per year <2 weeks of vessels on site per cable repair/remediation event 1 x major O&M campaign (tow back to port) each year WTGs Each WTG unit will have a diesel generator: 10 maximum Each WTG will require lubricating oils, hydraulic oils and coolants for operation using a geared system.	Corresponds to the maximum number of vessels that would realistically be expected to be operating simultaneously and the maximum number of diesel generators to be in operation. Each vessel contributes additional risk of accidental pollution incident.

9.6.3.84 Planned and unplanned activities may be required throughout the O&M phase of the Project (mooring, sub-structure inspection, cable repairs etc.). These may increase the risk of spillage or chemical contamination. Accidental spillage of lubricants, oils or chemicals may occur directly from the WTGs themselves, or from vessels present on site during maintenance activities.

9.6.3.85 It is expected that vessel presence for O&M activities will be limited to up to 6 x vessel visits per turbine per year; up to 2 weeks of vessels on site for each cable repair/remediation event and, on average, 1 major tow back to port for major O&M work on the semi-submersible floating platforms. Therefore, vessel activity on site will be less than required during the main construction period.

9.6.3.86 Standard mitigation measures of best practice will be employed at all times to reduce the risk of a pollution event; and an MPCP will be produced and agreed with stakeholders post-consent. In consideration of the strong hydrodynamic regime of the area, the embedded standard mitigation, and adoption of best practice, the magnitude of impact is assessed as negligible.

9.6.3.87 Table 9.25 (Section 9.6.2) summarises the key sensitivities of associated receptors to pollutants (e.g. oil) and in consideration of potential responses to such an impact, overall the receptor(s) are assessed as medium sensitivity.

9.6.3.88 In summary, in terms of potential effect on benthic habitats via the accidental release of pollutants from vessels and WTGs during the O&M phase, the negligible magnitude of the impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

9.6.3.89 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Accidental Release of Existing Contaminants Through Disturbance of the Seabed

9.6.3.90 The following is supported through information presented in Chapter 6: Marine and Coastal Processes and Chapter 7: Marine Seabed and Water Quality.

9.6.3.91 Table 9.39 summarises the key parameters for assessment of potential risk of accidental release of contaminants through disturbance of the seabed during O&M phase.

Table 9.39 – Summary of Worst Case Scenario for Sediment Disturbance

Realistic Worst Case Scenario	Justification
Operation period: 25 years <u>ECC</u> • 5 estimated repair events (export cable). • 1 km estimated cable repair length. • 250,000 m^2 total estimated export cable repair area • 600,000 m^2 total estimated footprint of 12 x cable remediation event. <u>Array area</u> • 5 estimated repair events (array cables) • 1,505,250 m^2 estimated cable repair area. • 1,303,194 m^2 m mooring line catenary swept area • 82,500 m^2 cable catenary swept area **Total Area of Temporary Habitat Disturbance (O&M): 3,740,944 m^2 (3.74 km^2)**	Corresponds to (a combination of) the greatest amount of material disturbed, the largest dimensions of trenching, the greatest depth of seabed lowering/levelling and the greatest geographical extent of the impact. The fastest rate of progress is used to assess the greatest rate of sediment disturbance or release. The installation of scour protection will cause a lesser rate and duration of sediment disturbance than cable installation (trenching).

9.6.3.92 As well as generating temporary increases in SSC, offshore export and/or array cable repairs and/or remediation activities are expected to result in some localised, seabed disturbance. It is expected that equipment similar to that used to install the offshore export cable will be used for cable repairs and/or cable remediation. Accordingly, the area of seabed impacted during the de-burial and removal of any area of export/array cable would be similar to (but no greater than) the area impacted during the installation of the same cables.

9.6.3.93 Placement of anchors or cable protection structures on the seabed also introduces the potential for localised changes to hydrodynamics. This may, in turn, potentially cause scour around these structures and the re-suspension of seabed sediments. Associated increased in suspended sediment concentration may lead to an increase in SSC (decreased water clarity), or mobilisation of contaminated benthic sediments into the water column.

9.6.3.94 The overall spatial extent of the impact of seabed disturbance via cable repairs and/or remediation will be less than experienced in the construction phase, in consideration of the more limited scale of works required. These activities will also occur temporarily and intermittently over the 25 year O&M phase. Any scour around structures will also be localised with low volumes of sediment disturbed.

9.6.3.95 The potential for mobilisation of contaminated sediments will be no greater than that identified for the construction phase (see Section 9.6.2) and, as such, the magnitude of impact is assessed as negligible

9.6.3.96 The sensitivity of the relevant benthic receptors is, overall, assessed as medium sensitivity.

9.6.3.97 In summary, in terms of potential remobilisation of contaminated sediments via cable repairs/remediation and/or localised scour, the negligible magnitude of the impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

9.6.3.98 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Effects of EMF and Heat from Active Power Cables

9.6.3.99 The following is supported through information presented in Volume 3, Technical Appendix 7.2: EMF Assessment. Table 9.40 summarises the key worst case EMF and heat parameters for the Project during the O&M Phase.

Table 9.40 – Summary of Worst Case EMF Parameters

Realistic Worst Case Scenario	Justification
Maximum operational period: 25 years Worst-case is surface-laid cable. No rock protection is optioned within nearshore between (KP0-KP4.6). **EMF Parameters** • 23.9 km array cable length • 49km export cable length • Max voltage array cable: 72.5 kV • Max voltage export cable: 66 kV EMF levels will be measurable at 7μT above background levels (48.7μT) at 0 m from the cable, decreasingly rapidly with distance to levels negligible from background at 4 m, and 5 m at cable crossings. EMF effects will be present in both the water and sediment within this area. Where the cable lies on the seabed, 50% of the area of increased EMF will be within the water column and 50% will be within the sediment. Up to 3.3 km) of array cable will be situated within the water column. The total volume of EMF influence will be **3,944,772 m^3 (0.0039 km^3)** of which a maximum of 2,061,661 m^3 (0.0021 km^3) will be entirely within the water column and 1,883,111 m^3 (0.0019 km^3) within the sediment. **Heat Parameters** Maximum temperature increase: 2.5°C Average temperature change; 0.8°C	The majority of offshore cables will be buried but calculations of EMF emissions are based on worst case of no burial, with rock bags placed at intervals for stability. This represents the worst case scenario where EMF emissions are measurable within a 4 m radius from all surface laid cables; and at cable crossings (three in total) this is slightly increased to a 5 m radius. For full breakdown see Volume 3, Technical Appendix 7.2: EMF Assessment. Heat values are based on a review of field experiment for Nysted offshore windfarm. For full review see Volume 3, Technical Appendix 7.2: EMF Assessment.

9.6.3.100 Electrical cables from offshore wind farms can emit electromagnetic fields (EMF) into the marine environment. An EMF is created by the transmission of electricity and magnetic fields through power cables and comprises both electric and magnetic components. The Project will include a maximum of 72.9 km of cables (23.9 km of array cables; 49.0 km of export cable), around which EMF can arise. The array cables have a maximum voltage of 72.5k kilovolt (kV) (with a standard operational voltage of 66 kV) and the export cable has a maximum voltage of 66 kV.

9.6.3.101 The effects of EMF naturally attenuate with distance, both vertically and horizontally from sources (i.e. the cable), and cable burial further reduces the effects from EMF. For cables laid on the surface of the seabed, without cable protection, half of the EMF influence will be present within the sediments and half within the water column. All cables for the Project will be buried, where possible at depths of 0-3 m, with a target depth of 2.5 m for the export cable. In areas where cable is exposed, rock protection will be placed on top. No cable protection is proposed for the export cable within 2.3 km of the coast (KP0-KP4.6), and, therefore, there is only a localised risk of exposed cables on the seabed across the near-field Study Area, and the subsequent potential impacts of EMF emissions across the wider area are, thus, low.

9.6.3.102 The background geomagnetic field for the Celtic Sea is approximately 48.7 μT (micro tesla) (review by Greenlink, 2019). Following the assessment parameters calculated for EMF for the Project, the worst case scenario from the EMF emissions is measurable at 7 μT above background levels at 0 m, but decreasing rapidly with distance at 4 m radius from all surface laid cables. At distances greater than 4 m from the source, the EMF field is unlikely to be distinguishable from background levels. At the cable crossings (three in total – two in the array area, one along the ECC), this area of influence can be higher, at 5 m; and, as such, the worst case scenario for the distance of detectable EMF impact at crossings is 5 m.

9.6.3.103 It has been calculated for the Project, as a worst case, that the total volume of EMF influence: is 0.0039 km^3. Of this, a maximum of 0.0021 km^3 will affect the water column, and 0.0019 km^3 affect the seabed. Of the volume of effects within the water column, 178,550 m^3 is from hang-offs, and this volume is considered negligible when considering the total available volume of both the array area and wider Study Area. These EMF effects will be confined to the highly localised area immediately surrounding the exposed cable which, in practice, will often be shielded with rock protection.

9.6.3.104 In consideration of both the cable design parameters, and the calculated volumes of EMF influence that are considered negligible in the context of both the array area and EEC, and the wider Study Area, the magnitude of this impact is considered negligible.

9.6.3.105 The effects of EMF on marine organisms are largely unknown for most species, but it is understood that they can be sensitive; particularly species that use magnetic fields for navigation, orientation and feeding (Scott *et al.*, 2012). For benthic organisms, it may trigger developmental, physiological and behavioural responses in sensitive species (review by Dannheim *et al.,* 2020), however, there is contradicting evidence on interactions between species from anthropogenic sources of magnetic fields (review by Greenlink, 2016).

9.6.3.106 Laboratory studies have been undertaken, often using higher magnetic fields on test specimens than would naturally be experienced close to cables, such as for those in the Project. Fertilisation in sea urchins has been shown to be delayed by up to an hour under the effect of increased EMFs (Zimmerman *et al.*, 1990), and a disruption to endocrine systems and changes in behaviour was reported for the brown crab *Cancer pagurus* (Scott, 2021); however, both experiments used magnetic fields several orders of magnitude greater than those expected for the project (0.1 mT and 2.8-40 mT, respectively).

9.6.3.107 There is the potential for aggregation of mobile epifaunal species around benthic cables. *C. pagarus* was observed to be attracted to EMF sources despite showing signs of physiological stress (Scott, 2021), whereas it has also been shown that other decapods were less abundant around cables, compared with control sites (Dunham *et al.,* 2015). Sessile benthic species may be more susceptible to long-term effects of EMF than mobile fauna, and in consideration of the paucity of species-specific data, a precautionary medium sensitivity is assigned to subtidal benthic ecological receptors.

9.6.3.108 In summary, in terms of potential remobilisation of EMF on benthic species, the negligible magnitude of the impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect, which is not significant in EIA terms.

9.6.3.109 Electricity transmission within the marine environment will also cause cables to become heated, relative to the ambient environment. Cables laid on the surface may emit heat energy, increasing the temperature at the cable surface, but with water flow above likely to reduce any effect. Buried cables can warm the sediments that are in direct contact, warming the immediate surrounding environment, with greater relative field of effects for cohesive sediments (several tens of cm's). These heating effects directly impact benthic species causing avoidance behaviour or physiological changes, or indirectly through modifying sediment properties and microorganisms communities and bacterial activity (Taormina, 2019).

9.6.3.110 Transmission assets for the proposed development are predicted to result in a maximum localised temperature increase of 2.5 °C, with average change in temperature of 0.8 °C. Any elevations in surface temperature are expected to be spatially limited to within tens of centimetres from the cable as the sediments across most of the ECC are sands and coarser sediments, not fine muds. Given this highly limited spatial extent it is expected that the magnitude of any effect will be negligible, limited to burrowing fauna.

9.6.3.111 There is a paucity of evidence for the potential effect of heat from subsea cables on benthic assemblages, but impacts are overall considered to not be significant (review by Taormina, 2019). A precautionary medium sensitivity is assigned to benthic community, notably for the exposed infaunal burrowing groups.

9.6.3.112 In summary, in terms of potential of heat emissions from subsea cables on benthic species, the negligible magnitude of the impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect, which is not significant in EIA terms.

Additional Mitigation and Residual Effect:

9.6.3.113 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Long-term changes to physical processes

9.6.3.114 The following is supported through information presented in Chapter 6: Marine and Coastal Processes.

9.6.3.115 Table 9.41 summarises the relevant worst case parameters got assessment of permanent changes to physical processes during the O&M phase.

Table 9.41 – Summary of Worst Case parameters for Permanent Change in Physical Processes

Realistic Worst Case Scenario	Justification
Mooring system and electrical cables • Maximum number of moorings and electrical cables present in the water column: 54 • Dimensions of mooring chain: links 0.81 m long x 0.67 m wide x 0.2 m diameter. • Swept area for mooring chain: 50 m lateral motion at touchdown • Dimensions of individual clump weights: 2 m long x 2 m wide x 1 m high • Diameter of electrical cable: 0.30 m • Dimensions of suction pile anchors once installed: 6.5 m diameter, 3 m above seabed. Cable protection (ECC and Greenlink crossing) - • Applied to up to 15.3 % (7.5 km) of the total export cable length • Applied to up to 100% (22.5 km) of the total array cable length in contact with the seabed • Rock protection berm or mattress • Maximum dimensions: 11 m base width x 2 m height (2 m berm crest width). Typical array cable protection dimensions 5 m base width x 1 m height, (rock bags). • Rock armour unit size: 2 to 30 cm	Largest number of moorings and cables (54) associated with: up to 10 foundations, 9 with 3 moorings each and 1 with 5 moorings = 32, + 20 array cable and 2 export cable connections. Embedment anchors will be completely buried and will not interact at all with waves or currents. Drilled piles may also extend up to 3 m above the seabed but have a smaller diameter (up to 2.5 m).

9.6.3.116 The long term placement of subsea structures on the seabed (e.g., cable protection; mooring lines), may result in localised scour around these structures due to changes in tidal currents and seabed morphology. Scour may, in turn, lead to a loss of sediment which may directly impact the physical structure of the adjacent habitats and indirectly effect resident benthic communities. Sediment type and hydrodynamics is an important consideration for predicting the degree of scour that can occur. Scour can increase over periods of years on sandy sediments, and over mixed gravelly sediments only the sand particles will re mobilise if tidal currents are not strong enough to sweep away heavier fractions (Whitehouse *et al.,* 2011).

9.6.3.117 For the Project, localised scour may occur in association with:

- Cable protection;
- Mooring lines;
- Mooring line clump weights; and
- Drilled, driven or suction pile anchors

9.6.3.118 **Scour around cable protection:** As a worst case, up to 15.3 % of the ECC may require cable protection. Placement of cable protection on surface laid subsea cables will prevent sediment scour around the cable, thus protecting it. However, a small amount of localised secondary scour may form at the edges of the berm, which will be in proportion to the overall dimensions (height and slope angle) of the berm, its position, and clast (rock fragment) size used.

9.6.3.119 Cable protection berm height will be limited to 2 m, with a base width of 11 m. Therefore, the footprint of any such rock berms only represents a very small proportion of the total water depth. The sloped sides (18°) of these berms are also designed to minimise the impact on tidal currents. The berm axis will potentially lie across the natural sediment transport pathways, which may present some obstruction to bedload transport. It is predicted that, initially, small volumes of sediment will accumulate on the updrift side, within and around the berm, as bedload transported sediment is trapped between gaps in the clast.

9.6.3.120 The volumes of sediment predicted to accumulate on the updrift side will range from 2-30 cm, reaching its maximum within an order of weeks to a few months. As the 18° slope of berm is within the range of naturally stable bed slopes, a stable sediment slope will develop and sediment transport will return to natural conditions over the berm, and no measurable change to seabed is expected more than a few meters from the updrift edge.

9.6.3.121 Downdrift of the berms, a small local depression (scour) may occur, but within only a few metres. and to a shallow depth (e.g only a few centimetres). This is as a result of the temporary reduction in sediment supply during initial accumulation on the updrift side of the berm. This pattern of accumulation or scour may naturally vary over the lifetime of the berm, and can be episodic or seasonal in nature; however, it is expected that there will be no measurable difference in sediment type or texture around these protection structures.

9.6.3.122 Within the SAC near Turbot Bank, rock protection is required for the cable crossing with the buried Greenlink cable, at the far north-western area of the feature (KP7.1 – KP7.3), some distance to the west of the crest of the bank (Volume 2, Figure 13b). The dimensions of the protection at the crossing will mirror that placed elsewhere across the ECC, with berm height limited to 2 m, and a base width of 11 m, and a worst-case area of footprint of 770 m^2.

9.6.3.123 The cable protection height at the Greenlink crossing (max. 2 m) is only a small proportion of the total water depth (at LAT). Where currents and waves interact with the berm, it is unlikely that the berm will present a sufficient obstacle to cause changes to their magnitude or direction beyond the very local near-bed area;

9.6.3.124 Where the berm axis is more closely aligned to the sediment transport direction, little to no measurable change to the seabed is expected more than a few metres from the edges of the berm. A small volume of sediment might accumulate gradually in the surface voids of the berm, but not likely in sufficient quantities to cause measurable changes to the surrounding seabed level. Where the berm axis is at a more acute angle to the sediment transport direction, see the description above for offshore areas; and

9.6.3.125 Any changes to waves, tides and sediment transport associated with the installation of cable protection between KP7.1 - 7.3 will not extend to Turbot Bank, the main crest of which is located around 2 km to the east.

9.6.3.126 As such, the limited impact of sediment processes over the operational period, as described above, is also applicable here for the Greenlink cable crossing at Turbot Bank.

9.6.3.127 **Scour around exposed pile anchors:** No scour protection is planned for the mooring system (pile and drag embedment anchors). Scour around the base of exposed ends of pile anchors may cause disturbance relative to their diameter, however the limited height of these obstacles reduces the likely maximum dimensions (a few metres depth and <tens of metres extent), which is much less than would be expected from a full water column height obstacle such as a monopile.

9.6.3.128 **Scour around chain links and clump weights:** Mooring structures that are above the seabed, such as chain links and clump weights, can interact with nearbed currents, which may result in local flow patterns and seabed scour effects. However, it has been assessed that these are individually of relatively small scale and so are unlikely to cause a change in overall patterns of flow or sediment transport through the array area, and thus will be of minimal impact of benthic communities.

9.6.3.129 **Scour around catenary 'swept areas':** The mooring chains may occasionally move in response to movement of the semi-submersible floating platform. The speed of movement is expected to be slow and may include both lateral and vertical movement. This action may cause a 'ploughing' or 'sweeping' of sediment', re-distributing volumes into accumulations of <1 m high, and the net effect maybe an area of disturbed seabed morphology. However, it has been assessed that any features formed will gradually return to a natural state through sediment transport processes.

9.6.3.130 In summary, the magnitude of impact of scouring to benthic ecology, caused by placement of these subsea structures, is assessed as low. There is no measurable change to the seabed, more than a few metres either side of the cable protection in the ECC. Similarly, any impacts arising from the presence of the mooring and anchoring system within the array area, are deemed to not be significant, as any changes to the seabed are expected to be difficult to discern from those which may occur under baseline conditions. It has also been assessed that any changes to physical processes through the installation of cable protection for the Greenlink crossing will be limited across the sandbank Turbot Bank, between KP7.1-KP7.3.

9.6.3.131 This potential effect has been assessed against VER Groups of the array and offshore ECC. Both VER groups I and L are typical of dynamic areas, particularly in the section of the ECC closer to shore. These VERs have been assigned a low-medium sensitivity.

9.6.3.132 Based on preliminary cable burial and protection studies done to date, cable protection is predicted to be required within the boundary of the SAC. With the proximity to these receptor groups, including the Annex I Turbot bank sandbank, but in consideration of their highly dynamic nature and the supporting benthic communities resilient to physical pressures that may arise from scour, a precautionary medium sensitivity is assigned overall.

9.6.3.133 In summary, the low magnitude of the effect, combined with the medium sensitivity of the receptor, results in the impact of changes to physical processes to be considered as having **minor adverse** effect, which is not significant in EIA terms.

9.6.3.134 In summary, in terms of potential localised scour around project structures leading to impacts on benthic communities, the negligible magnitude of the impact combined with the medium sensitivity of the receptor results in a **minor adverse** effect, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

9.6.3.135 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

9.6.4 Decommissioning

9.6.4.1 During the decommissioning phase there is the potential for WTG, foundation and cable removal activities to impact benthic ecology receptors. The impacts that will occur during decommission are assumed to be the same or similar, to those assessed during construction and include:

- Temporary habitat disturbances from infrastructure removal (direct);
- Temporary increases in suspended sediments/smothering from removal of infrastructure (indirect);
- Introduction of INNS (indirect);
- Protection of benthic habitats from fishing restrictions (direct);
- Accidental release of pollutants from vessels (direct); and
- Accidental release of contaminants.

9.6.4.2 The magnitude of these effects and the sensitivity of the receptor groups is considered to remain overall the same as per the construction phase impacts, although in practice they are likely to be reduced for decommissioning. Therefore, the same conclusions on impact significance are predicted. Where there is a potential variation, these are presented below.

Introduction of INNS (direct)

9.6.4.3 As assessed for the construction phase, there is the risk of introductions of INNS to the Study Area through the increased vessel presence required for decommissioning. Potential risk of the spread of INNS will also arise during decommissioning through the removal of infrastructure (e.g., semi-submersible floating platforms), and its transportation away from site.

9.6.4.4 Over the 25 year lifetime of the Project, these structures may have become colonised with fauna, including INNS. The development of biosecurity plans and compliance with relevant guidance regarding ballast water is expected to reduce overall risk from vessels, and the removal of structures.

9.6.4.5 Therefore, following the assessment as done for the construction phase, the magnitude of impact is assessed as negligible, and as a precaution, the sensitivity of the benthic receptors as medium.

9.6.4.6 In summary, the negligible magnitude of the effect, combined with the medium sensitivity of the receptor, results in the impact of introduction of INNS to be considered as having **minor adverse** effect, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

9.6.4.7 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

9.6.5 Annex I Interaction Summary

9.6.5.1 The assessment described separately the potential interaction between Project impacts and Annex I features of the SAC. Table 9.42 provides a summary of these assessments, listing the extent of each overlap (km), and as a percentage proportion of each feature within the SAC. These numbers are in part, an over estimate, as are not expressed as a proportion of the total area of Annex features that are estimated from both within and outside the SAC boundary, as reported under Article 17 (e.g. for Turbot Bank). All area values of each Annex I feature were sourced from Lle Geo-Data Portal (2021); a data and information partnership hub of Welsh Government and NRW.

9.6.5.2 Under the Report to Inform Appropriate Assessment (RIAA) (Volume 3, Technical Appendix 8.3: Report to Inform Appropriate Assessment), for the designated Annex I habitats of the SAC, it is understood that for assessments of potential Project interactions with Annex I features, these will be calculated against the values listed in the Natura 2000 Standard Data Form to assess for no adverse effects on integrity of the SAC (AEOI) (JNCC, 2015).

Table 9.42: Spatial interaction (km^2) between relevant impacts and Annex I habitats in the near-field Study Area of the SAC, and the % proportion of the total extent of features in the SAC (Annex I feature areas sourced from Lle Geo-Data Portal, 2021).

Impact	SAC Annex I Feature	Area in SAC (km^2)	Interaction (km^2)	% of SAC Feature
Construction Phase				
Temporary habitat disturbance - sandwave levelling - open cut trenching	Intertidal Reef (rocky)	11.53 km^2	0.00028 km^2	0.002429%
	Subtidal Reef (rocky)	433.15 km^2	0.000498 km^2	0.00011497%
	All reef (rocky)	444.68 km^2	0.000778 km^2	0.00017496%
	Intertidal mudflats and sandflats	19.01 km^2	0.003333 km^2	0.0175329 %
	Turbot Bank sandbank	19.1 km^2	0.007917 km^2	0.04145026%
	All Sandbanks	51.59 km^2	0.007917 km^2	0.015346%

Impact	SAC Annex I Feature	Area in SAC (km^2)	Interaction (km^2)	% of SAC Feature
Operation and Maintenance Phase				
Long-term habitat loss - cable protection - HDD exit protection - open cut trenching (permanent habitat loss)	Intertidal Reef (rocky)	11.53 km^2	0 km^2	0%
	Subtidal Reef (rocky)	433.15 km^2	0.000146 km^2	0.000034%
	All reef (rocky)	444.68 km^2	0.000146 km^2	0.000033%
	Intertidal mudflats and sandflats	19.01 km^2	0 km^2	0%
	Turbot Bank sandbank	19.1 km^2	0.0021 km^2	0.010995%
	All Sandbanks	51.59 km^2	0.0021 km^2	0.004071%
Decommissioning Phase				
Temporary habitat disturbance	Interaction expected to be same as for construction.			

9.6.6 Effects on Human Health and Population

9.6.6.1 There will be no effects on population or human health in relation to benthic ecology. Potential effects on coastal water quality and any local bathing beaches via increased SSC are fully assessed in Chapter 7: Marine Sediment and Water Quality.

9.7 Additional Mitigation

9.7.1.1 No additional mitigation is suggested in relation to benthic ecology.

9.8 Monitoring

9.8.1.1 The following monitoring is proposed by the Applicant and is anticipated to form part of a Environmental Mitigation and Monitoring Plan (EMMP) to be agreed with NRW prior to the commencement of construction:

- Benthic grab and DDV surveys of the array area and ECC. Surveys to be undertaken pre-construction (within 12 months of works) and then in years 1, 5 and 10 post-construction. The survey design will focus on key areas of interest and be agreed in consultation with NRW and JNCC but likely include:
  - Array area where catenary effects from the moorings may arise;
  - Sandwave areas along the ECC;
  - ECC in close proximity to Turbot Bank; and
  - Landfall and shallow sub-tidal areas.

9.9 Inter-Related Effects

9.9.1.1 The assessment of impacts arising from construction, operation and decommissioning of the Project indicates that impacts on receptors addressed in different aspects of the Project may potentially further contribute to the impacts assessed on benthic ecology and *vice versa*. These are primarily from:

- Chapter 6: Marine and Coastal Processes;
- Chapter 7: Marine Seabed and Water Quality;
- Chapter 10: Fish and Shellfish; and
- Chapter 15: Commercial Fisheries.

9.9.1.2 The worst-case impacts assessed within this chapter take these interactions into account and therefore the impact assessments are considered conservative and robust. For clarity, the areas of interaction between impacts are listed below:

- Temporary habitat disturbances, permanent and long-term habitat loss. This has been assessed within Section 9.6.2 for construction phase (and in Section 9.6.3 and 9.6.4 for O&M and decommissioning), and in Chapter 10: Fish and Shellfish;
- Increased suspended sediment (and smothering). This has been assessed within Section 9.6.2 for construction phase (and in Section 9.6.3 and 9.6.4 for O&M and decommissioning), and in Chapter 6: Marine and Coastal Processes, Chapter 7: Marine Sediment and Water Quality and Chapter 10: Fish and Shellfish;
- Protection of benthic habitats from fishing restrictions. This has been assessed within Section 9.6.2 for construction phase (and in Section 9.6.3 and 9.6.4 for O&M and decommissioning), and in part, in Chapter 10: Fish and Shellfish (for reduced fishing pressures) and Chapter 15: Commercial Fisheries (for loss of access to grounds);
- Accidental release of pollutants. This has been assessed within Section 9.6.2 for construction phase (and in Section 9.6.3 and 9.6.4 for O&M and decommissioning), and in Chapter 7: Marine Sediment and Water Quality;
- Accidental release of contaminants from disturbance of sediments. This has been assessed within Section 9.6.2 for construction phase (and in Section 9.6.3 and 9.6.4 for O&M and decommissioning), and in Chapter 7: Marine Sediment and Water Quality;
- Long-term loss of habitat via project infrastructure. This has been assessed within Section 9.6.3 of this chapter, and in Chapter 10: Fish and Shellfish; and
- Effects of EMF emissions from electrical cables. This has been assessed within Section 9.6.3 of this chapter, and in Chapter 10: Fish and Shellfish.

9.10 Cumulative Effects Assessment

9.10.1 Overview

9.10.1.1 A Cumulative Effects Assessment (CEA) has been made based on existing and proposed developments in the Study Area (Chapter 30: Cumulative Effects). The approach to the CEA is described in Chapter 30: Cumulative Effects. Cumulative effects are defined as those effects on a receptor that may arise when the development is considered together with other reasonably foreseeable projects. Construction for the Project is estimated to last 8 months between 2026 and 2027 with offshore pre-construction surveys taking place in April 2026.

9.10.1.2 The majority of impacts on benthic ecology receptors associated with this Project have a spatial extent that is limited to within the footprint of works and operational activities, and the immediate local surroundings. However, it is also important to consider potential secondary impacts that may occur from plumes of disturbed sediments across the variable tidal excursions of the Study Area.

9.10.1.3 Therefore, only projects that will affect the immediate local environment shall be screened in for consideration in the cumulative assessment, and with additional reference to those proposed developments identified as relevant for marine and coastal processes (Chapter 6: Marine and Coastal Processes).

9.10.1.4 On this basis, the projects considered within this cumulative assessment are listed and summarised in Table 9.43. Further information is outlined in Chapter 30: Cumulative Effects. The cumulative impacts with the nearby Marine Energy Test Area (META) phase 2 project are not screened here due to the short lifespan of the Project. The META project is expected to be completed by the time that the Proposed Development has commenced.

Table 9.43 – Summary of Projects relevant for Cumulative Assessment in relation to Benthic Ecology

Development Type	Project	Tier	Distance from array area (km)	Distance from ECC (km)	Development Footprint (km^2)	Construction Timings
FLOW	Project Valorous	2	3.3	9.7	4.7[2]	2026- 2028 (generating 2029)
Interconnector	Greenlink	2	17.8	0	0.16	2024
Marine Energy Test Site	META Dale Roads	2	39.6	2.3	0.195	As a test site deployment and recovery will be dictated by client bookings. There is no programme and activity will be managed by NtM and stakeholder update
Marine Energy (wave power test site)	Marine Energy Bombora Demonstrator (META) East Pickard Bay	1	40	3.0	1.23	Summer 2022 for a maximum duration of 18 months including removal
Marine Energy Test Site	META Warrior Way	2	51.7	12.6	0.093	As a test site deployment and recovery will be dictated by client bookings. There is no programme and activity will be managed by NtM and stakeholder updates.

[2] Value calculated based on estimated 300 MW installation and an export cable length of 59 km.

9.10.1.5 Although localised work on the Pembroke Dock Slipway was identified within the cumulative effects long list, this has been excluded from further assessment as it is expected to be completed before works on the Proposed Development commence, and it is not expected that there will be any additional operational impacts that require consideration within the cumulative assessment.

9.10.1.6 The potential cumulative effects of the Pembrokeshire Demonstration Zone (PDZ) have not been considered at the time of writing due to the lack of detail with which to assess the effects of the proposed project. An EIA Scoping Report was produced and issued to NRW in 2018 for a proposed wave/floating wind project however based on discussions with Celtic Sea Power (the 3rd party agents for the PDZ) and recent public presentations by members of Celtic Sea Power, it is understood the PDZ will be repurposed as an offshore electrical hub. In the absence of an updated EIA Scoping Report and insufficient project information to allow the effects to be reasonably understood and a cumulative assessment undertaken, it has been omitted from this assessment.

9.10.1.7 For those reasons identified above, including the absence of EIA Scoping Reports, the potential cumulative impacts of the recently announced Llyr 1, Llyr 2 and Whitecross FLOW projects are also omitted from this cumulative assessment.

9.10.1.8 As set out in PINS Guidance Note 17: Cumulative Effects Assessment, the Project proposed an assessment cut-off date of 1 October 2021 to allow the finalisation of the EIA and HRA assessments, even if project information came forward between the cut-off date and submission. This was agreed with NRW Marine Licensing, noting that in the absence of S.36/Marine Licence guidance the Project was drawing upon the best available advice. It is understood that should sufficient detail of these projects come forward following submission the Project may be requested to provide additional information during the determination period.

9.10.1.9 The likelihood of any significant cumulative impacts on benthic ecology occurring would largely depend on the extent of each development, in particular developments that directly interacts with the seabed and results in a direct or indirect disturbance of benthic habitat and species. The extent of all cumulative effects will be largely dependent on the timings of the construction, O&M, and decommissioning phases of the other developments, and the temporal overlap likely to occur.

9.10.1.10 The potential cumulative effects that will be considered across all Project phases will include:

- Long-term habitat loss;
- Temporary habitat disturbance;
- Temporary increases in SSC/smothering;
- Changes in physical processes;
- Accidental release of pollutants;
- Accidental release of contaminants from disturbance of sediment;
- Introduction of INNS; and
- EMF emissions.

9.10.1.11 The consideration of projects that could result in potential cumulative effects is assessed based on the results of the assessment, a review of the status of other projects, and the professional judgement of specialist consultants.

9.10.2 Construction

Temporary habitat disturbance

9.10.2.1 The nearby Greenlink Interconnector will be in operation once construction of the Project commences (Table 9.43). Therefore, cumulative effects via temporary habitat disturbance would only arise if construction activities for the Project occurred at the same time as cable repair/remediation works on the installed Greenlink interconnector cable.

9.10.2.2 Cable repair/remediation works be required on Greenlink during the construction period of the Project, and it is expected that five interventions will be required during their O&M phase. It is unlikely that the cumulative effect of temporary habitat disturbance would change the magnitude of the impact from low, as it is unlikely that the full five repair events for Greenlink will be required during the Project construction phase. If they did occur simultaneously with Project works, then the impact would be very small in relation to the availability of habitat across the wider study area. Therefore, the cumulative impact would be **minor adverse**, which is not significant in EIA terms.

9.10.2.3 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Temporary increases in suspended solids/smothering and changes to physical processes

9.10.2.4 The following is supported through information presented in Chapter 6: Marine and Coastal Processes.

9.10.2.5 All of the projects, plans and activities set out in Table 9.43 have the potential to cause localised temporary increases in SSC due to the installation or removal of structures on the bed. If activities were occurring at the same time as construction (or decommissioning) works for the Project, there may be potential for cumulative increases in SSC and associated effects of smothering on the benthos. Interactions between sediment plumes generated by disturbance activities of the various developments could theoretically occur in two ways. Firstly, plumes generated, meet and coalesce to firm one larger plume; or sediment disturbance occurs within a plume generated by the Project (or *vice versa* another development). The main scope for cumulative impact is the increased SSC via the installation works for the Project, in combination with Greenlink cable repair and remediation works.

9.10.2.6 Sediment plume interaction generally has the potential to occur if the activities generating the sediment plumes are located within one spring tidal excursion ellipse from one another and occur at the same time. Under mean spring conditions the maximum tidal excursion is approximately:

- 10 km around the array area;
- 14-15 km around the middle of the ECC (approximately KP20);
- 18-19 km in the nearshore approaches to Milford Haven (approximately KP10); and
- 4 km within Milford Haven.

9.10.2.7 All of the projects listed in Table 9.43 are within a spring tidal excursion eclipse from either the array area and or the ECC and, thus, may potentially experience a measurable change in SSC from a dispersing sediment plume.

9.10.2.8 For the most part, the sediment disturbance activities associated with the Project are likely to involve the release of coarse-grained material, and finer material from activities at the surface and drilling associated with the installation of mooring systems. Modelling has shown that any coarse grained sediments will be spatially constrained to point source of disturbance, and finer sediments will be subject to rapid dispersion and will be return to background levels within <2 km.

9.10.2.9 Across the other development projects that are expected to already be in operation during the Project's construction phase, any maintenance works that may be required will unlikely to be frequent enough to result in a significant change to SSC across the Study Area. In consideration of the above the cumulative effect would be **minor adverse,** which is not significant in EIA terms.

9.10.2.10 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Risk of introductions of INNS

9.10.2.11 As presented under Section 9.6.2, INNS can be introduced to the near-field Study Area during installation of Project infrastructure and from increased vessel activity. With the exception of the Greenlink Interconnector, where there is a single overlap at a route crossing of cables, all other developments are distant from either the array area or the ECC. Therefore, the overall magnitude of impact remains negligible, as any additive risk from vessel activity from Greenlink, can be expected to be minimal during its O&M phase, and thus the cumulative effect would be **minor adverse**, which is not significant in EIA terms.

9.10.2.12 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Accidental release of pollutants from vessels

9.10.2.13 The following is supported through information presented in Chapter 7: Marine Seabed and Water Quality.

9.10.2.14 The potential for release of pollution from leaks or spills of fuels, chemicals or construction materials introduces risk of deterioration of water quality. Such incidents may occur at any location within the Project and, as such, the assessment of potential cumulative affect must include all of the developments screened into assessment. During the construction phase of the Project, there is the potential temporal overlap with cable installation works and the Greenlink cable repair works, whereby increased vessel activity may be occurring simultaneously in the area.

9.10.2.15 As detailed in Section 9.6.2, best practice techniques will be employed at all times to reduce the risk of pollution events as far as possible. An MPCP will be produced and agreed with stakeholders post-consent. This document will detail mitigation measures that will be employed to prevent pollution events, and the emergency response procedure and notifications that would be required should an incident occur.

9.10.2.16 The adoption of construction best practice and utilisation of MPCPs or similar (e.g. shipboard oil pollution emergency plans) is standard within marine developments and will be similarly adopted at the other projects considered. In addition, given the expected low incidence of pollution events during construction, it is considered highly unlikely that any such incidents that did occur would be associated with the temporal and spatial overlap necessary to result in cumulative effects. In view of the control measures that will be put in place to avoid accidental chemical contamination events, or address one should it occur, the magnitude of potential impact is considered to be negligible, and the subsequent cumulative effect would be **minor adverse**, which is not significant in EIA terms.

9.10.2.17 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Accidental release of contaminants from disturbance of sediments

9.10.2.18 The following is supported through information presented in Chapter 7: Marine Seabed and Water Quality.

9.10.2.19 The ECC of the Project intersects the Greenlink Interconnector route and is 3 km from the Bombora Wave Energy project. However, construction of both these developments is expected to be completed by prior to works starting for the Project As such there will be no temporal overlap with construction associated with the Project. However, cumulative effects may occur, if operational cable reburial works required for these sites occur during construction of the proposed development.

9.10.2.20 The Greenlink Interconnector route will pass close to the historic Milford Haven dredge disposal ground, and the ECC for the Proposed Development will intersect the footprint of this disused spoil area. However, as there is an absence of elevated contaminant levels in sediments collected close to the historic disposal site, this suggests that there is low risk that cable installation through this area will result in mobilisation of contaminated sediments. The risk associated with disturbance of these sediments is further decreased, given the low chance of interaction between, and the small SSC increase associated with, respective sediment plumes.

9.10.2.21 Site-specific sediment sample data are not available for the Project Valorous project at the time of assessment and similarly, the ES for the Bombora Wave Energy Development does not provide site specific sediment sample data, but notes that "*Whilst the Milford Haven Waterway has a notable industrial history, with major petrochemical and port development along its banks contributing to sediment contamination, the exposed coastal area to the south of the Angle peninsular, where mWave will be deployed, is remote and undeveloped. As such the potential for significant sediment contamination to be present in this area is highly unlikely*" (BWP, 2019).

9.10.2.22 It is considered unlikely that there will be sufficient temporal and spatial overlap for interaction between sediments mobilised during the construction activities required for these projects. However, even if this does occur, the low contaminant levels in underlying sediments ensures that the magnitude of any increase would be low. Based on this a **minor adverse** effect is predicted, which is not significant in EIA terms.

9.10.2.23 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

9.10.3 Operation

Long-term loss of habitat from project infrastructure

9.10.3.1 Following the initial placement of project infrastructure on the seabed during construction, there will be a direct long-term (25 years) habitat loss for benthic communities within the Study Area during O&M. Under the worst case scenario this has been estimated to be 163,001 m^2 (0.16 km^2) (Table 9.28).

9.10.3.2 By the time the Project is planned to move into its O&M phase (end of 2027), all other developments will have been in operation, aside from Project Valorous where its construction phase is due to be completed by 2030. The total area of estimated permanent loss of habitat of all other developments, excluding Project Valorous is 1,701,300 m^2 (1.70 km^2).

9.10.3.3 As a worst case scenario for assessment of cumulative impact of habitat loss from infrastructure, all of the developments listed in Table 9.43 will be considered. The FLOW Project Valorous has an estimated footprint of permanent habitat loss via project infrastructure of 4.7 km^2.

9.10.3.4 As assessed under Section 9.6.3, there is a long-term habitat loss from cable protection at the cable crossings of the Project with the Greenlink cable route, at the far western edge of the Turbot Bank in the SAC. The Valorous cable route is expected to be installed along a similar route to the Project ECC, but in no location would cables be closer than 150 m to one another and thus it is not expected that cable protection would be required for a crossing between these projects.

9.10.3.5 As assessed in Section 9.6.3 for the magnitude of this impact from the Project for key benthic receptor groups, the calculated loss of habitat represents only a small proportion of the benthic habitat that is available both within the Study Area of the Project, and in the wider region. Therefore, the cumulative effect would be **minor adverse**, which is not significant in EIA terms.

9.10.3.6 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Temporary disturbance of habitat from cable repairs and remediation

9.10.3.7 The Greenlink Interconnector and META projects developments will have overlaps in operation alongside the Project, albeit occurring across different locations. Cumulative effects would only be likely to occur should repair and remediation works be required on both the Project and these installations simultaneously. Except for the Greenlink Interconnector cable crossing, where there is a single cable crossing, all other developments are at distances significant enough to prevent an assessed increase in magnitude of this impact (of low as assessed in Section 9.6.3), as a result of cumulative effect. As such, the cumulative effect is considered **minor adverse**, which is not significant in EIA terms.

9.10.3.8 At the Greenlink cable crossing there is the potential for repairs and remediation works to overlap or occur in close proximity to one another. Should this occur it is unlikely that the cumulative effects would change the magnitude of the impact from low, due to the wide availability of similar habitat across the wider study area. Therefore, the cumulative effect of the Greenlink Interconnector cable with the Project would be **minor adverse**, which is not significant in EIA terms.

9.10.3.9 The Project is expected to be in operation once the construction of Project Valorous commences, and as such the only cumulative effect for this impact would be during maintenance works of the Project. For the same reasons as above, the cumulative effect is considered **minor adverse**, which is not significant in EIA terms.

9.10.3.10 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Temporary increases in suspended solids/smothering and changes in physical processes

9.10.3.11 The following is supported through information presented in Chapter 6: Marine and Coastal Processes.

9.10.3.12 All of the developments listed in Table 9.43 have the potential to cause temporary increases in SSC during their operational life history, from maintenance and routine operational activities at the seabed. However, it is anticipated that due to the overall distance between these developments, and the infrequency of occurrence when disturbances may occur, that the cumulative effects of suspended sediment plumes and associated smothering of the seabed will be low and thus the cumulative effect is considered **minor adverse**, which is not significant in EIA terms.

9.10.3.13 The Valorous FLOW project will still be under construction at a time when the Project commences its O&M phase. The Valorous offshore export cable is expected to be installed along a broadly similar route to the Project ECC, although in no location would cables from these projects be closer than 150 m to one another. In theory, sand wave levelling could be undertaken along both the ECC, and the Valorous offshore export cable at this minimum distance. Because sand wave levelling activities would not occur simultaneously (as Valorous is currently planned to be constructed after the Project), there is no potential for the coalescence of sediment plumes and any subsequent increase in SSC and, therefore, the cumulative effect is considered **minor adverse**, which is not significant in EIA terms.

9.10.3.14 However, the longer-term implications for any changes in sediment transport to downdrift to locations, including the Annex I Turbot Bank sandbank are considered. No sandwave levelling is proposed within the SAC, however these features are assessed as having the capacity to recover to disturbances associated with levelling. For sandwave levelling, any sediment removed from the seabed would, preferentially be re-deposited in close proximately to its source location. As such, for each development, no material would be removed from the local sediment transport system and, therefore, there is little implication for cumulative interactions between them, or morphological impacts to downdrift receptors. The overall level of effect significance has been determined as **minor adverse** effect**,** by combining the medium sensitivity assigned for this feature and the low magnitude, as assessed under Section 9.6.3.

9.10.3.15 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Colonisation of infrastructure from INNS

9.10.3.16 As assessed under Section 9.6.3, during the O&M phase, the installed infrastructure may provide suitable artificial habitat for INNS, and a risk of introductions to the area may occur from vessels undertaking operation and maintenance activities.

9.10.3.17 The Project will be in operation for up to 25 years, and the screened in developments can range from ones with short operational periods (e.g., test projects), to those having a similar life cycle (e.g., Project Valorous). These projects may provide the suitable substrate and interconnectivity for hard bottom INNS epifauna to colonise and locally extend their distribution, in a sedimentary environment that would otherwise not be suitable.

9.10.3.18 It was estimated that within the Study Area, as a worst case, 0.56% of it would be available for colonisation by INNS via the availability of these new submarine surfaces. The spatial distribution of the developments, combined with the Project across the region, means that this scale of potential surface availability is reduced. Furthermore, it can be assumed that for all developments, that the appropriate and standard mitigation measures will also be in place to reduce the risk of introduction of INNS to these areas via vessels undertaking maintenance and operation activities. Overall, it is assessed that the cumulative impact of colonisation of INNS is of **minor adverse** effect, which is not significant in EIA terms.

9.10.3.19 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Accidental release of pollutant from vessels and WTG

9.10.3.20 The following is supported through information presented in Chapter 7: Marine Seabed and Water Quality.

9.10.3.21 The potential for release of pollution from leaks or spills of fuels and chemicals introduces risk of impacting the receiving benthic environment. Such incidents may occur at any location within the Project and, as such, the assessment of potential cumulative affect must include all of the other developments screened into assessment.

9.10.3.22 All potential cumulative impacts to benthic habitats from accidental pollution events during the O&M phase, will be no greater than that identified for the construction phase and therefore no associated effect is predicted and therefore is assessed as **minor adverse**, which is not significant in EIA terms.

9.10.3.23 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

Accidental release of contaminants from disturbance of sediments

9.10.3.24 The following is supported through information presented in Chapter 6: Marine and Coastal Processes, and Chapter 7: Marine Seabed and Water Quality.

9.10.3.25 Benthic sediments may be mobilised through scouring effects caused by installation of turbine foundations, anchor points and cable protection. Sediment re-suspension could lead to deterioration in water quality.

9.10.3.26 Placement of turbine anchors or cable protection structures on the seabed introduces potential for localised changes to hydrodynamics, potentially causing scour and the resuspension of seabed sediments. Associated increases in SSC may lead to decreased water clarity or introduction of contaminated benthic sediments into the water column.

9.10.3.27 However, due to the negligible magnitude of SSC increase predicted, it is considered that there is no realistic risk of cumulative effects with other projects. As such, no associated effect is predicted, and remains assessed as **minor adverse**, which is not significant in EIA terms.

9.10.3.28 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

EMF emissions from power cables

9.10.3.29 The following is supported through information presented in Volume 3, Technical Appendix 7.2: EMF Assessment.

9.10.3.30 The total length of cable from the Project, with the potential to cause EMF effects, has been assessed as 72.9 km. The length within UK waters of the Greenlink Interconnector cable is estimated at 73.9 km. An estimated 0.33 km of cable is currently suggested for the META project. Project Valorous will require an offshore export cable and array cables, however the length of these cables has not yet been determined. Project Valorous is likely to be situated up to 21 km from the Pembrokeshire coast, and this distance has therefore, been used for this assessment.

9.10.3.31 Not accounting for potential array cables, the estimated area of EMF effect across projects, assuming a 4 m radius for all cables, is determined to be 0.010 km^3 (as calculated in Volume 3, Technical Appendix 7.2: EMF Assessment). Even when considering the additional area of EMF effect likely to result from the array cables for Project Valorous and the Project, this volume is considered negligible in the context of the wider study area. Therefore, the cumulative effect is considered **minor adverse**, which is not significant in EIA terms.

9.10.3.32 None of the effects identified above is major or moderate adverse (significant in EIA terms). Therefore, no additional mitigation is required to reduce the significance to non-significant in EIA terms and the significance of residual effects remains as detailed above.

9.10.4 Decommissioning

9.10.4.1 The same type and significance of cumulative impacts as described for the construction phase, would potentially arise if decommissioning of the Project and the other projects in the vicinity occurred simultaneously. As such, a **minor adverse** significance is assessed overall, which is not significant in EIA terms.

9.11 Transboundary

9.11.1.1 In view of the limited spatial extent of potential impacts on benthic ecological receptors from the Project, and the distance to national waters of nearest neighbour state (>60 km), it is considered that there is no potential for transboundary effects.

9.12 Summary

9.12.1.1 This chapter has assessed the potential impacts which may occur on benthic ecology within the construction, O&M, and decommissioning phases of the Project.

9.12.1.2 Review of the existing baseline and ground truthing data collected as part of the baseline surveys, concludes that across the areas encompassing the Project (the Study Area), a rich mosaic of intertidal and subtidal rocky and sedimentary benthic habitats is present. These spatial distribution patterns in benthic habitats and species, are a natural reflection of both local and regional variations in geology, sediment, and hydrodynamic and geomorphological processes.

9.12.1.3 The Project overlaps with the relevant designated sites of Sir Benfro Forol/Pembrokeshire Marine SAC, and the Arfordir Penryn Angle/Angle Peninsular Coast SSSI, which are both designated, in part, due to important benthic habitats and/or species. The FOCI of Annex I habitats, Section 7/OSPAR habitats (and species), and INNS have been identified as present within the Study Area, and overlapping with expected spatial and temporal phases of the Project. Of notable relevance to this assessment was the extent of features of Annex I reefs, subtidal sandbanks and intertidal sandbanks, and mudflats.

9.12.1.4 The benthic biotopes, habitats and FOCI that have been identified and mapped, were assigned to one of 12 receptor groups (VERs), in consideration of their physical habitat, biology and sensitivities, for the effective assessment of impacts across this physically and biologically diverse benthic area.

9.12.1.5 The range of potential impacts and associated effects, and standard mitigation considered for benthic ecology, has been informed by Scoping responses and from subsequent discussions with stakeholders. Potential pressures considered by this assessment included:

- Loss of habitat (long-term and permanent);
- Habitat disturbance;
- Increases in suspended sediment concentrations/smothering;
- Changes to physical processes (bed morphology and tidal currents causing scour);
- The introductions and colonisation of INNS;
- Colonisation of infrastructure from (non INNS) marine species;
- Protection of benthic habitats from fishing restrictions;
- Accidental release of pollutants and indirect release of contaminant from sediment disturbance; and
- EMF and heat emission from power cables.

9.12.1.6 The magnitude of impact of each pressure, assessed against each individual receptor group (or set of groups) was, overall, determined to range from negligible to low. This took into consideration factors such as the scale and nature of each impact occurring across the habitat (or FOCI), and the availability of these habitats and features across the Study Area, and wider region.

9.12.1.7 The sensitivities of the key biotopes representing each receptor group were assessed for each pressure and, overall, were determined to range from low to medium. Dependent upon the biotopes ascribed, these would take into the account sensitivities of the biological and physical components.

9.12.1.8 With consideration of the Standard Mitigation measures, the effect of all pressures was assessed as **minor adverse**, even when assessed with worst-case scenarios. Standard Mitigation measures will be implemented to ensure that the risks to benthic ecology are managed effectively over the lifetime of the project. The EIA concluded that the significance of effect was not significant, as outlined in Table 9.44.

9.12.1.9 With consideration of all other projects and plans that may interact with the Project during its lifetime, no significant cumulative impacts on benthic ecology have been identified (Table 9.45). Accordingly, no additional mitigation has been proposed to that already embedded in the existing Project Development Design.

Table 9.44 – Summary of Effects for Marine and Coastal Ecology

Description of Effect	Significance of Potential Effect (assuming standard mitigation implemented)		Additional Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Construction					
Temporary habitat disturbance (direct and indirect)	Minor	Adverse	None required	Minor	Adverse
Temporary increases in suspended sediments/ smothering (indirect)	Minor	Adverse		Minor	Adverse
Introduction of INNS (indirect)	Minor	Adverse		Minor	Adverse
Protection of benthic habitats from fishing restrictions (indirect)	Minor	Beneficial		Minor	Beneficial
Accidental release of pollutants from vessels (direct)	Minor	Adverse		Minor	Adverse
Accidental release of pollutants through disturbance of the sediments (indirect)	Minor	Adverse		Minor	Adverse
Operation					
Long-term and permanent habitat loss (direct)	Minor	Adverse	None required	Minor	Adverse
Temporary habitat disturbance (direct)	Minor	Adverse		Minor	Adverse
Temporary increases in suspended sediments/ smothering (indirect)	Minor	Adverse		Minor	Adverse
Colonisation of infrastructure by INNS (indirect)	Minor	Adverse		Minor	Adverse
Colonisation of infrastructure by marine organisms (non INNS) (indirect)	Minor	Beneficial		Minor	Beneficial

Description of Effect	Significance of Potential Effect (assuming standard mitigation implemented)		Additional Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Protection of benthic habitats from fishing restrictions (indirect)	Minor	Beneficial		Minor	Beneficial
Accidental release of pollutants from vessels (direct)	Minor	Adverse		Minor	Adverse
Accidental release of pollutants through disturbance of the sediments (indirect)	Minor	Adverse		Minor	Adverse
EMF and heat from electrical cables (direct)	Minor	Adverse		Minor	Adverse
Long term changes to physical processes (indirect)	Minor	Adverse		Minor	Adverse
Decommissioning					
Temporary habitat disturbance (direct and indirect)	Minor	Adverse	None Required	Minor	Adverse
Temporary increases in suspended sediments/ smothering (indirect)	Minor	Adverse		Minor	Adverse
Introduction of INNS (indirect)	Minor	Adverse		Minor	Adverse
Accidental release of pollutants from vessels (direct)	Minor	Adverse		Minor	Adverse
Accidental release of pollutants through disturbance of the sediments (indirect)	Minor	Adverse		Minor	Adverse

Table 9.45 – Summary of Cumulative Effects for Marine and Coastal Ecology

Description of Effect	Cumulative Developments	Significance of Cumulative Effect	
		Significance	Beneficial/ Adverse
Construction			
Temporary habitat disturbances from installation (indirect and indirect)	• Greenlink Interconnector • META projects • Project Valorous	Minor	Adverse
Temporary increased suspended sediment/smothering) and changes to physical processes from installation (indirect)	As above	Minor	Adverse
Introduction of INNS (indirect) from vessel activities	As above	Minor	Adverse
Accidental release of pollutants from vessels (direct)	As above	Minor	Adverse
Accidental release of contaminants from disturbance of sediments (indirect)	As above	Minor	Adverse
Operation			
Long-term loss of habitat via project infrastructure (direct)	• Greenlink Interconnector • META projects • Project Valorous	Minor	Adverse
Temporary habitat disturbances via repair and remediation works (direct)	As above	Minor	Adverse

Description of Effect	Cumulative Developments	Significance of Cumulative Effect	
		Significance	**Beneficial/ Adverse**
Increased suspended sediment and sediment deposition via repairs and remediation works and changes to physical processes (indirect)	As above	Minor	Adverse
Colonisation of infrastructure by INNS (indirect)	As above	Minor	Adverse
Accidental release of pollutants from vessels and WTG's (direct).	As above	Minor	Adverse
Accidental release of contaminants from disturbed sediments (indirect)	As above	Minor	Adverse
EMF effects from cables (direct)	As above	Minor	Adverse
Decommissioning			
The same type and significance of cumulative impacts as described for the construction phase would potentially arise if decommissioning of the Project and the other projects in the vicinity occurred simultaneously, resulting in no greater than minor adverse impacts.			

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