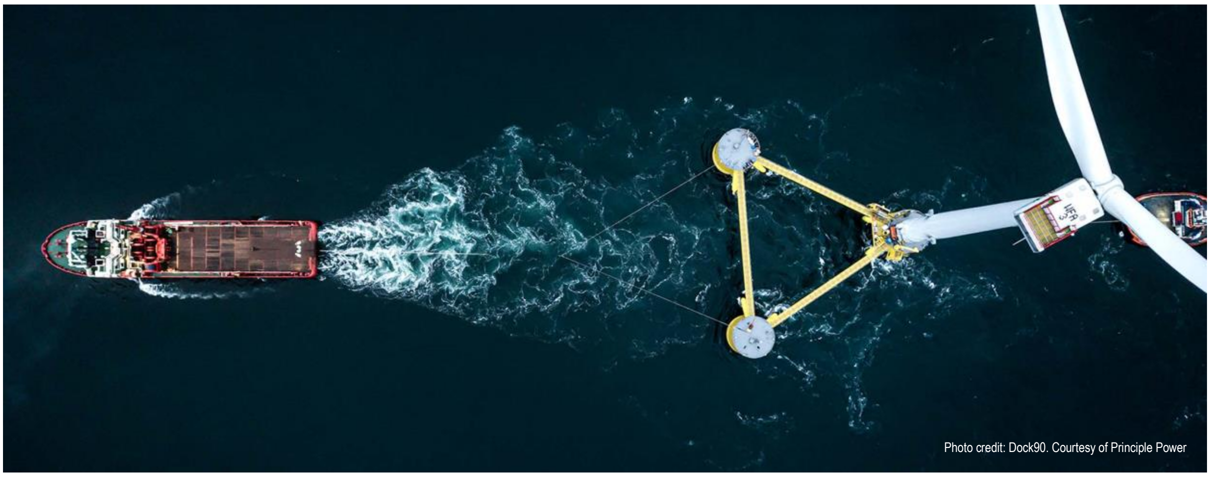

REPORT

Blue Gem Wind Project – Project Valorous
Environmental Impact Assessment Scoping Report

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Glossary

Acronym / Abbreviation	Description	Acronym / Abbreviation	Description
AA	Appropriate Assessment	**NERL**	NATS En Route plc
AEMP	Adaptive Environmental Management Plan	**NFFO**	National Federation of Fisherman's Organisations
AEZ	Archaeological Exclusion Zone	**NGESO**	National Grid Electricity System Operator
AIS	Automatic Identification System	**NGET**	National Grid Electricity Transmission
AONB	Area of Outstanding Natural Beauty	**NJUG**	National Joint Utilities Group
AoS	Area of Search	**nm**	Nautical Mile
AQMA	Air Quality Management Area	**NNR**	National Nature Reserve
AQT	Aquatera	**NOAA**	National Oceanic and Atmospheric Administration
ATC	Air Traffic Control	**NPL**	National Physical Laboratory
AURN	Automatic Urban and Rural Network	**NRA**	Navigational Risk Assessment
BAT	Best Available Technique	**NRW**	Natural Resources Wales
BGS	British Geological Survey	**NRW MLT**	Natural Resources Wales Permitting Service Marine Licensing Team
BGW	Blue Gem Wind	**NSIP**	Nationally Significant Infrastructure Project
BoCC	Birds of Conservation Concern	**NTM**	Notice to Mariners
BTO	British Trust for Ornithology	**NTS**	Non-Technical Summary
CAA	Civil Aviation Authority	**NVC**	National Vegetation Classification
CCC	Committee on Climate Change	**OFTO**	Offshore Transmission Operator
CCGT	Combined-Cycle Gas Turbine	**OLS**	Obstacle Limitation Surface
CEA	Cumulative Effects Assessment	**O&M**	Operational and Maintenance
Cefas	Centre for Environment, Fisheries and Aquaculture Science	**ONS**	Office for National Statistics
CFP	Common Fisheries Policy	**ORE Catapult**	Offshore Renewable Energy Catapult

Acronym / Abbreviation	Description	Acronym / Abbreviation	Description
CFPO	Cornish Fish Producers Association	**ORPAD**	Offshore Renewables Protocol for Archaeological Discoveries
CIA	Cumulative Impact Assessment	**OSPAR**	The Convention for the Protection of the Marine Environment of the North-East Atlantic
CoCP	Code of Construction Practice	**OWF**	Offshore Wind Farm
CRM	Collision Risk Modelling	**PAD**	Protocol for Archaeological Discoveries
CTVs	Crew Transfer Vessels	**PAH**	Polycyclic Aromatic Hydrocarbons
D&SIFCA	Devon and Severn Inshore Fisheries and Conservation Authority	**PCBs**	Polychlorinated Biphenyls
DAS	Digital Aerial Surveys	**PCC**	Pembrokeshire County Council
DBA	Desk-based Assessment	**PCNP**	Pembrokeshire Coast National Park
DCO	Development Consent Order	**PCNPA**	Pembrokeshire Coast National Park Authority
DCWW	Dŵr Cymru Welsh Water	**PDE**	Project Design Envelope
Defra	Department for Environment, Food and Rural Affairs	**PDZ**	Pembrokeshire Demonstration Zone
EC	European Commission	**PINS**	Planning Inspectorate
ECC	Export Cable Corridor	**PIZ**	Primary Impact Zone
EIA	Environmental Impact Assessment	**POW**	Point-on-Wave
EMF	Electromagnetic Field	**PPG**	Pollution Prevention Guidelines
EPS	European Protected Species	**PPI**	Principle Power Inc.
ERCoP	Emergency Response Co-operation Plan	**PSR**	Primary Surveillance Radar
ES	Environmental Statement	**RBMP**	River Basin Management Plan
ESAS	European Seabirds at Sea	**RiAA**	Report to inform Appropriate Assessment
EQS	Environmental Quality Standard	**RIGS**	Regionally Important Geological Site
ERCoP	Emergency Response Co-operation Plan	**RNLI**	Royal National Lifeboat Institute
EUNIS	European Nature Information System	**ROV**	Remote Operated Vehicle

Acronym / Abbreviation	Description	Acronym / Abbreviation	Description
FAME	Future of the Atlantic Marine Environment	**RSPB**	Royal Society for the Protection of Birds
FLO	Fisheries Liaison Officer	**RYA**	Royal Yachting Association
FLOW	Floating Offshore Wind	**S.36**	Section 36 consent
GEART	Guidelines for the Environmental Assessment of Road Traffic	**SAC**	Special Area of Conservation
GCN	Great Crested Newt	**SAR**	Search and Rescue
GCR	Geological Conservation Review	**SBE**	Simply Blue Energy 1 Ltd
GIS	Geographical Information System	**SCA**	Seascape Character Areas
GLVIA	Guidelines for Landscape and Visual Impact Assessment	**SCADA**	Supervisory Control and Data Acquisition
GPP	Guidance for Pollution Prevention	**SCI**	Sites of Community Importance
GVA	Gross Value Added	**SD**	Standard Deviation
HDD	Horizontal Directional Drilling	**SIZ**	Secondary Impact Zone
HER	Historic Environment Record	**SLVIA**	Seascape, Landscape and Visual Impact Assessment
HRA	Habitats Regulations Assessment	**SNCB**	Statutory Nature Conservation Body
HVAC	High Voltage Alternating Current	**SNH**	Scottish National Heritage
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities	**SPA**	Special Protection Area
IAQM	Institute of Air Quality Management	**SPG**	Supplementary Planning Guidance
ICES	International Council for the Exploration of the Sea	**S-P-R**	Source-Pathway-Receptor
IFP/ATCSMAC	Instrument Flight Procedures and ATC Surveillance Minimum Altitude Chart	**SSSI**	Site of Special Scientific Interest
IHO	International Hydrographic Organisation	**SSR**	Secondary Surveillance Radar
IMO	International Maritime Organisation	**STAR**	Seabird Tracking and Research
INNS	Invasive Non-native Species	**STECF**	Scientific, Technical and Economic Committee for Fisheries
IROPI	Imperative Reasons of Overriding Public Interest	**SEIFPO**	South East Ireland Fish Producers Organisation

Acronym / Abbreviation	Description	Acronym / Abbreviation	Description
ISQG	Interim Sediment Quality Guidelines	**SWFPO**	South West Fish Producers Organisation
ITPE	ITPEnergised	**SWIFPO**	South West Ireland Fish Producers Organisation
IUCN Red List	The International Union for Conservation of Nature's Red List of Threatened Species	**SWWFC**	South and West Wales Fishing Communities
JNCC	Joint Nature Conservation Committee	**TBT**	Tributyltin
KIS-ORCA	Kingfisher Information Service-Offshore Renewable & Cable Awareness	**TCE**	The Crown Estate
LAQM	Local Air Quality Management	**TEC**	Transmission Entry Capacity
LAT	Lowest Astronomical Tide	**THC**	Total Hydrocarbon Content
LCA	Landscape Character Areas	**THLS**	Trinity House Lighthouse Service
LDP	Local Development Plan	**TNUoS**	Transmission Network Use of System
LNG	Liquefied Natural Gas	**TOPA**	Airport Technical and Operational Assessment
LNR	Local Nature Reserve	**TSS**	Traffic Separation System
LPA	Local Planning Authority	**UAV**	Unmanned Aerial Vehicle
LSE	Likely Significant Effect	**UKC**	Under Keel Clearance
MAIB	Marine Accident Investigation Branch	**UKHO**	UK Hydrographic Office
MarLIN	Marine Information Network	**UXO**	Unexploded Ordnance
MARPOL	International Convention for the Prevention of Pollution from Ships	**VERs**	Valued Ecological Receptors
MCA	Maritime and Coastguard Agency	**VMS**	Vessel Monitoring System
MCAA	Marine and Coastal Access Act 2009	**WCPS**	West Coast Palaeolandscapes Survey
MCZ	Marine Conservation Zone	**WeBS**	Wetland Bird Survey
META	Marine Energy Test Area	**WFA**	Welsh Fishermen's Association
MHPA	Milford Haven Port Authority	**WFD**	Water Framework Directive
MMMU	Marine Mammal Management Unit	**WFPO**	Western Fish Producers Association

Acronym / Abbreviation	Description	Acronym / Abbreviation	Description
MMO	Marine Management Organisation	**WG**	Welsh Government
MoD	Ministry of Defence	**WIMD**	Welsh Index of Multiple Deprivation
MSL	Mean Sea Level	**WMFAG**	Welsh Marine Fisheries Advisory Group
MSS	Marine Science Scotland	**WNMP**	Welsh National Marine Plan
NATS	National Air Traffic Services	**WSI**	Written Scheme of Investigation
NBN	National Biodiversity Network	**WTG**	Wind Turbine Generator
NCMPA	Nature Conservation Marine Protected Area	**WWSFA**	West Wales Shell Fisherman's Association
NDFA	North Devon Fishermen's Association	**ZoI**	Zone of Influence
NE	Natural England	**ZTV**	Zone of Theoretical Visibility

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1 Introduction

1.1 Purpose of the Document

This Environmental Impact Assessment (EIA) Scoping Report has been prepared by MarineSpace Ltd and ITP Energised (ITPE) on behalf of Blue Gem Wind Ltd (BGW) in support of a formal request for an EIA Scoping Opinion for the proposed Project Valorous Floating Offshore Wind (FLOW) development.

A Scoping Opinion is requested from the following organisations under the EIA Regulations listed below:

- Natural Resources Wales (NRW) - Marine Works (EIA) Regulations 2007 (as amended); and
- Planning Inspectorate (acting on behalf of Welsh Ministers)[1] - The Electricity Works (EIA) (England and Wales) Regulations 2017.

This report has been prepared in accordance with the relevant legislation and guidance, and consultation with NRW, Welsh Government (WG) Planning Directorate, and the Planning Inspectorate (PINS). A description of the project along with BGW's proposed approach to the EIA is provided.

1.2 Project Overview

BGW is the developer for Project Valorous, a proposed FLOW development in the Celtic Sea region (hereafter referred to as the 'proposed Project'). The proposed Project is located approximately 47 km southwest of the Pembrokeshire coastline, in an outline area of interest of approximately 155 km^2, with approximate water depths of 70 - 84 m at the offshore array area Figure 1.1 shows the outline area and indicative offshore export cable corridor options.

The key Project components are:

- Between 18 and 31 Wind Turbine Generators (WTGs), of total capacity up to 300 MW, as well as the associated floating semi-submersible platforms and mooring infrastructure;
- A single (1) offshore substation;
- Inter-array cables and offshore export cables to landfall;
- Onshore cabling between landfall and the grid connection; and
- Onshore substation close to the grid connection point.

[1] Regulation 39 of The Electricity Works (EIA) (England and Wales) Regulations 2017 (as amended) permits deferral of EIA considerations in respect of applications under S.36 of the Electricity Act 1989, from the Welsh Ministers to NRW. A formal request was issued by BGW to the Welsh Ministers, via PINS, to invoke Regulation 39, which was accepted on the 11 January 2021. Therefore, a single Scoping Opinion request will be issued by NRW covering all aspects of the proposed Project. A copy of the Scoping Report will be sent to PINS for information.

1.3 Offshore Array Area Site Boundary

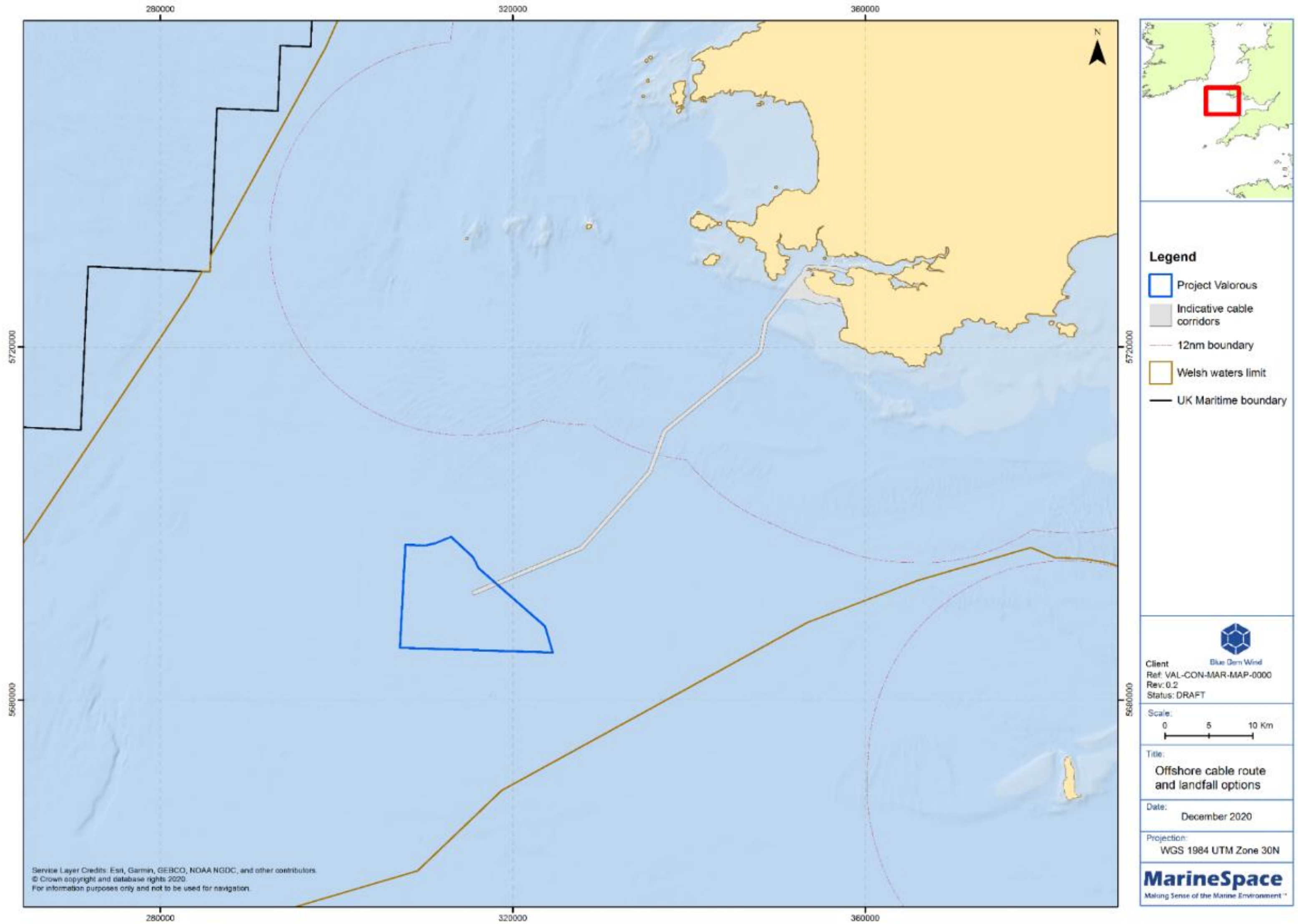
The offshore array area is the area in which the offshore infrastructure (WTGs, offshore substation etc.) will be located. The coordinates for the offshore array area site boundary are outlined in Table 1.1.

The final offshore array area boundary and coordinates will be determined following award of an option agreement from The Crown Estate (TCE) and prior to the submission of relevant consent applications. The total site area at the point of consent application and subsequent lease option exercise is anticipated to be reduced further still, to approximately 100 km^2 or less, in accordance with anticipated TCE lease exercise related capacity to area ratio requirements. The final offshore array area site boundary is therefore anticipated to be within, and represent a proportion of, the site boundary presented in this Scoping Report.

Table 1.1 - Valorous offshore array area site boundary coordinates

	Latitude			Longitude		
1	51°	23.8141	N	5°	46.2000	W
2	51°	23.8175	N	5°	45.7636	W
3	51°	23.8267	N	5°	43.7827	W
4	51°	23.9600	N	5°	42.9014	W
5	51°	24.4031	N	5°	41.3314	W
6	51°	23.2138	N	5°	39.1230	W
7	51°	22.9140	N	5°	38.8378	W
8	51°	22.6613	N	5°	38.6495	W
9	51°	19.1350	N	5°	31.8472	W
10	51°	17.5512	N	5°	30.9976	W
11	51°	17.5080	N	5°	46.4707	W

Figure 1.1 - Valorous offshore site, cable route and landfall options



1.4 The Developer

Simply Blue Energy, a pioneering Celtic Sea energy developer, and Total, one of the world's largest energy companies, have established a partnership to develop floating wind projects in the Celtic Sea region. The joint venture, known as Blue Gem Wind (BGW) was announced in March 2020 and opens a new chapter in the development of offshore energy in the UK. BGW's vision is defined below:

"Our vision is to create a new low carbon offshore energy sector in the Celtic Sea that contributes to climate change targets, provides high skilled jobs, supply chain diversification and energy security."

BGW believes that a stepping-stone approach, starting with smaller projects and then gradually increasing in size, is the best way to increase learning and maximise the opportunities to the local economy. Stepping-stone projects seek to provide local, Welsh and UK supply chain companies with the greatest chance to grow with this new sector as it expands globally.

The proposed 300 MW early-commercial project, Valorous, follows the 96 MW demonstration project Erebus, which is Wales' first floating offshore wind project (the EIA Scoping Report for Project Erebus was submitted in October 2019). Valorous will provide further opportunities for local supply chain before potential commercial scale projects are progressed in the 2030's.

Since its foundation in 2011, Simply Blue Energy has focused on exploring sustainable blue economy opportunities in the Celtic Sea with offices in Ireland, Wales and Cornwall. The company has, therefore, gained a thorough understanding of the region and built key relationships and synergies within the local area. This experience is maintained into the joint venture with Total. Total is committed to the global development of offshore wind and sees the first two projects in the Celtic Sea as important stepping-stone projects in the development of floating offshore wind.

1.5 Project Need

1.5.1 United Kingdom and Wales Carbon Emissions Targets

The UK established legally binding target to reduce carbon emissions through the Climate Change Act 2008. In June 2019, amendments to the Climate Change Act 2008 saw the reduction in carbon emissions to be achieved by 2050 from 80% to 100% from the 1990 baseline, also known as Net Zero. This followed from a paper published by the Committee on Climate Change (CCC), 'Net Zero – the UK's contribution to Global Warming' in May 2019 (CCC, 2019a) making the recommendations to government to reduce emissions by at least 100%.

Monitoring by the CCC, to identify if the UK is on track to meet this target, confirmed the first (2008-12) and second (2013-17) carbon budgets have been met, and the UK is on target to meet the third (2018-22). The UK is not, currently, on track to meet the fourth (2023-27) target and 2018 records show emissions being 44% below 1990 levels (CCC, 2019b). The UK Government has confirmed that an over-arching Net Zero Strategy will be developed prior to the pivotal COP26 climate summit in 2021 (BEIS, 2020a).

As a devolved administration, the Welsh Government (WG) has created a climate change policy through the Environment (Wales) Act 2016, which sets emission reduction targets for Wales. In response to the CCC May 2019 paper, Wales has accepted the recommendation for a 95% reduction in emissions by 2050, with an ambition to reach net-zero (CCC, 2019b).

1.5.2 United Kingdom and Wales Renewable Energy Targets

The UK has committed to producing 15% of energy demands from renewable sources by 2020 and the CCC considers there is scope for 30-45% of all energy consumption to be produced by renewable energy (DECC, 2011). In 2019, UK renewables generated 48.5% of the country's electricity (National Grid, 2020).

In October 2020, the Prime Minister announced further commitments in order to reach Net Zero by 2050, which included a target for floating offshore wind to deliver 1 GW of energy by 2030 (BEIS, 2020b). The announcement was followed by the publication of The Ten Point Plan for a Green Industrial Revolution (HM Government, 2020) and the Energy White Paper: Powering our Net Zero Future (BEIS, 2020c) which set out how the UK will achieve the targets.

Wales is a significant net exporter of electricity, with approximately half of electricity produced being exported to England, Ireland and the wider European network (WG, 2018a). A review undertaken in 2018 by the WG found 25% of total electricity generated in Wales is from renewables, equivalent to 50% of Wales' consumption. 67% of the renewable electricity generated comes from wind, of which 30% is generated by offshore wind projects.

Energy Wales – A Low Carbon Transition (WG, 2012) sets WG's commitment to renewable energy generation in Wales and recognises the potential for Wales to be a world leader in marine renewables. In 2017, WG announced a target of meeting 70% of Wales' electricity demand from Welsh renewable sources by 2030 (WG, 2017).

In March 2019, WG published 'Prosperity for All: A Low Carbon Wales' (WG, 2019a) setting out 100 policies and proposals to meet the UK's 2020 carbon emissions targets. The document also highlighted that Wales is making good progress towards to the 70% target, with renewable electricity equivalent to 48% of consumption.

1.5.3 Welsh National Marine Plan

The WG published and adopted the first Welsh National Marine Plan (WNMP) in November 2019 (WG, 2019b). Since adoption, the WNMP must be adhered to and relevant public authorities must consider it when making decisions regarding the Welsh marine area. The WNMP covers Welsh inshore and offshore waters and seeks to ensure marine resources are used in a sustainable way in line with the high-level marine objectives. The WNMP sets out policies to achieve this, including general and sector specific policies.

The Energy – Low Carbon policies in the WNMP support future FLOW opportunities in Welsh waters and recognises the significant contributions that the offshore renewable energy sector, including FLOW, can make to decarbonising the Welsh economy.

. The WG values the strategic need to develop marine renewable energy generation capacity and considers this will be achieved through the deployment of demonstration and commercial scale renewable technologies (WG, 2018a).

The **ELC_01: Low carbon energy (supporting) wind** policy states:

> ***ELC_01 a***: *Proposals for offshore wind energy generation will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.*
>
> *Proposals for wind >350MW will be considered by UK Government in accordance with relevant national policy. In determining an NSIP for a wind proposal, the decision maker will have regard to this plan. Any determination in relation to energy developments of any scale will be taken in accordance with this plan alongside any other relevant considerations.*

> ***ELC_01 b**: In order to understand future opportunities for offshore wind development, including floating technologies, this plan supports strategic planning for the sector. Relevant public authorities and the sector are encouraged, in liaison with other interested parties, to collaborate to understand opportunities for the sustainable use of wind energy resources including identification of:*
>
> *• natural resources that provide potential opportunity for future use;*
>
> *• evidence to de-risk consenting for the sector; and*
>
> *• opportunities to define and, once in place, further develop and refine Strategic Resource Areas for offshore wind energy resource safeguarding;*
>
> *in order to support the sustainable development of the sector through marine planning.*
>
> *Relevant public authorities should make appropriate evidence available to support planning and decision making in order to support the sustainable development of the sector through marine planning, where it is appropriate to do so.*

1.5.4 Purpose of Valorous Floating Offshore Wind Farm

BGW has adopted a plan-led approach to identifying projects and sites that are potentially suitable for development through demonstration and commercial scale technologies.

Project Valorous is a site that has been identified via BGW’s site selection process as outlined below, and the adopted ‘Stepping-Stone Strategy’. The project aims to build on foundations and learning from BGW’s demonstration-scale FLOW project, Project Erebus. The purpose of Project Valorous will be:

- To demonstrate the deployment of FLOW at early-commercial scale (300 MW of total capacity);
- To further stimulate the development of an indigenous supply chain and Operation & Maintenance (O&M) services; and
- To progress investment toward commercial deployment of FLOW in the whole of the Celtic Sea.

1.6 Site Selection and Project Development

1.6.1 Overview and Studies Completed

A wide range of studies have been undertaken to date by, and on behalf of, BGW, to identify the preferred offshore array area for the proposed Project. Final project details, including type / configuration of WTGs, offshore substation location, offshore cable routes, landfall location, onshore cable route, and onshore substation location will be informed by further surveys and assessment and plans will be finalised prior to the submission of consent applications (and the supporting Environmental Statement (ES)) to the relevant authorities.

The following section provides a summary of previous and ongoing site selection work undertaken in relation to the proposed Project. This section is intended to demonstrate that a large amount of work has already been done to rule out alternative locations and routes. A full description of the site selection and consideration of alternatives process will be provided within the final ES, as requirement by the 2017 EIA Regulations.

Studies that have been commissioned by BGW to inform the ongoing site selection process are detailed below:

- GIS-based constraint mapping and site selection review (Aquatera, 2019);
- Project Valorous Site Selection Review (MarineSpace, 2020a) and Addendum (MarineSpace, 2020b);
- Phase 1 Project Valorous Cable Array Design Report (ITPE, 2020a);
- Phase 1 Project Valorous Outline Electrical Design Report (ITPE, 2020b);
- Phase 1 Project Valorous Onshore Infrastructure Constraints Report (ITPE, 2020c);
- Valorous Offshore Substation Concept Design Report (Empire Engineering, 2020);
- Valorous Site Seabed Assessment and comparative review with Erebus (OWC, 2020a);
- Valorous Outline Design Report (OWC, 2020b);
- Geological Desk Top Study, Erebus Stage 1 Floating Windfarm (Intertek, 2019);
- WindFloat Design for a generic 12+MW Wind Turbine (PPI, 2019); and
- Metocean Analysis Desk Study (Wave Venture, 2019).

1.6.2 Offshore Array

1.6.2.1 *Initial GIS-based Site Selection (Aquatera)*

The offshore array area where the floating WTGs will be deployed was identified following an extensive GIS-based constraints mapping exercise undertaken by Aquatera (AQT), on behalf of Simply Blue Energy (AQT, 2019). The initial Area of Search (AoS) was defined by Simply Blue Energy as the Southwest Approaches region of the UK. The Southwest Approaches region was selected by Simply Blue Energy as the AoS due to its previous work in this region since 2011, and its wish to build upon the "*Celtic Sea Alliance*" concept of knowledge sharing and development between Ireland, Wales and Cornwall.

AQT used its proprietary GIS-tool (RADMAPP) to undertake constraint mapping, with the following initial groups of constraints considered further in Table 1.2:

Table 1.2 - Initial Constraints Considered in Site Selection

Issue Type	Constraint Considered
Technical	• Bathymetry; • Depth of quaternary sediments; • Current velocity; and • Average wave height.
Cost / Profitability Constraints	• Average wind velocity; • Distance from grid; and • Distance from service port.
Environmental Constraints	• Locations of key bird sensitivities; • Locations of key marine mammal sensitivities; • Designated nature conservation areas; and

Issue Type	Constraint Considered
	• Zone of Theoretical Visibility (ZTV) classified by distance.
Other Sea Users	• Shipping lanes; • Fishing areas; • Military exercise areas; and • Existing infrastructure and proposed projects.

The RADMAPP tool was used to assign a suitability score ranging from 1.0 to 0.0 to each parameter, based on its suitability for the development in question. A score of 1.0 meant that the parameter was completely suitable, and a score of 0.0 meant that the parameter was a barrier to development.

Due to the complexity and uncertainty of the information surrounding onshore substations and available grid capacity, 3 scenarios were run:

- Scenario 1: No distance from substation parameter;
- Scenario 2: Distance from 400 kV substation parameter included; and
- Scenario 3: Distance from substations believed to hold sufficient capacity for this project.

All 3 results were broadly comparable in terms of the most suitable locations.

Following completion of the first run of the Model, the by now established BGW team provided greater input into the process, reviewing and editing suitability scores, as well as adding additional parameters into the Model.

Further runs of the Model were undertaken and a series of development polygons were identified around the most suitable areas identified by RADMAPP. Further analysis of each area was then carried out to compare and contrast the features within each area.

Following this final analysis and production of potential development area maps, BGW then engaged with TCE, presenting all the information from the suitability mapping and successive analysis. Subsequently, based on the discussions with TCE, BGW decided to take forward two areas for further investigation: Area 2 (Project Erebus) and Area 3 (Project Valorous).

1.6.2.2 *Site Selection Review (MarineSpace)*

Prior to the commencement of the formal EIA scoping process, BGW commissioned MarineSpace to undertake a review of all work done by AQT, to sense-check and validate the site selection process, and to ensure that more-suitable, alternative sites did not exist, prior to further studies commencing on the preferred site.

This review concluded that whilst the original GIS-based mapping work was robust and based on valid assumptions, there were certain datasets and additional information available, that could be input to RADMAPP to further inform the constraints mapping work.

A summary of key additional data identified, and added to the review process, is presented below:

- Review of new data that that was not available in the previous site selection undertaken for Project Valorous, such as British Trust for Ornithology (BTO) paper on the foraging ranges of seabirds (December 2019), proposed new marine developments, seabird and cetacean populations (Waggitt *et al*., 2019);
- Inclusion of additional and more recent shipping data for areas further offshore than those identified in the initial screening exercise;
- Consideration of any relevant policy and legislative updates, for example the publication of the Welsh National Marine Plan (WNMP); and
- Development of suitability scoring for new data sets in consultation with BGW.

Following the input of these additions, RADMAPP was re-run to assess whether the proposed location for the Project was still the most viable location. This revised assessment confirmed the proposed Project location was the optimal location for a 300 MW FLOW project.

1.6.2.3 *Site Selection Review – Addendum (MarineSpace)*

Guidance from TCE states that seabed lease applications should not be within 5 km of other areas for lease agreement owned by the same applicant, until such time that the development has progressed to at least the point where the main offshore consent application has been submitted (TCE, 2018).

The Valorous offshore array boundary in the original Site Selection Review (detailed in Section 1.6.2.2) was within 5 km of BGW's demonstrator project, Erebus. To meet the guidance requirements, options for amended boundaries were presented in an addendum to the Site Selection Review.

The final proposed Project offshore array area site boundary and coordinates will be determined following award of an option agreement from TCE, prior to the submission of relevant consent applications, and after consent applications for Erebus have been submitted. The final boundary is expected to be within the boundary area presented within this Scoping Report.

1.6.3 Offshore Substation

BGW commissioned a study by external consultants to explore available concepts and design aspects of offshore substations, along with an initial review of potentially suitable locations within the Valorous offshore array area. This work has identified 3 potential sites along the eastern extent of the offshore array area boundary. The exact location, type and design of the offshore substation structure will be determined following detailed assessment and further design processes.

1.6.4 Grid Connection

The Project has a grid connection agreement in place with National Grid Electricity System Operator (NGESO). This agreement subsequently outlines the point of connection agreed for the Project at National Grid Electricity Transmission (NGET) owned Pembroke 400 kV Substation, adjacent to the Pembroke Power Station

1.6.5 Marine Export Cables

A range of potential marine export cable routes from the main array site to landfall have been considered as part of early-stage feasibility work. GIS-based constraints mapping was carried out, with the data sources outlined in Section 1.6.2.2 used to inform this work. Key constraints considered in the appraisal of marine cable routes included marine habitats within the Pembrokeshire Marine Special Area of Conservation (SAC), large sand wave features, recorded wrecks, Ministry of Defence (MoD) firing areas, an explosive dumping ground and high-density shipping lanes.

A long-list of 24 offshore cable route options were initially identified, ranging from Broad Haven (North) to the north and Freshwater East to the south. These options were assessed against a series of technical, economic, environmental and other stakeholder (i.e. MoD, Milford Haven Port Authority (MHPA)) criteria.

Following this assessment, the following export cable routes were identified as viable options and are presented within this report – see Figure 1.1.

1. Freshwater West;
2. Angle Bay (Sawdern Point);
3. West Angle Bay; and
4. Angle Peninsula South Coast between Whitedole Bay and Gravel Bay.

As part of ongoing project development, these potential routes will be assessed further so that a preferred option can be fixed prior to the main EIA commencing. Responses to this Scoping Report relevant to these route options will also be fully considered in the final route selection.

1.6.6 Marine Export Cables Landfall Sites

Similarly to the approach detailed in Section 1.6.5 for export cable routes, a range of potential landfall options have also been considered. GIS-based constraints mapping was again the key tool for site selection, complemented by local knowledge from MarineSpace staff who have worked on other projects in this area.

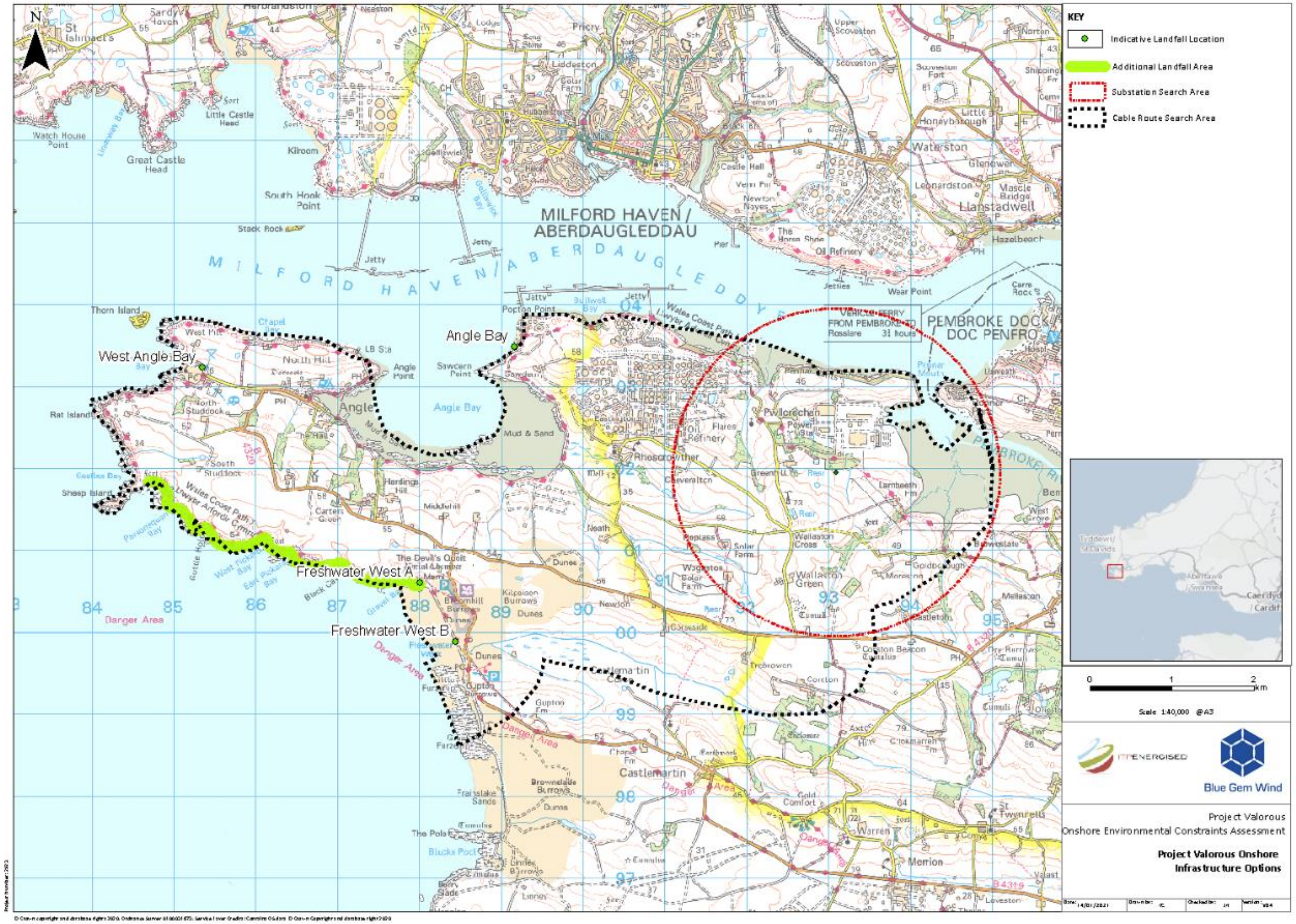
A long-list of 13 potential landfall locations were initially identified, covering the same broad geographic extent as the export cable routes. Assessment was carried out of each landfall option against the same criteria as for the export cable route selection. Certain landfall options were ruled out due to interaction with MoD land following discussions with this key stakeholder. Other options were ruled out due to subsequent excessive onshore cable routes – see below.

The current landfall options that are under consideration are the same locations as above for the export cable route (Freshwater Bay, Angle Bay (Sawdern Point), West Angle Bay and Angle Peninsula South Coast).

1.6.7 Onshore Cable Routes

The potential onshore cable route options were intrinsically linked to the long-list of landfall options, thus resulting in a long-list of 13 potential onshore routes (the same number as for the landfall long-list). These routes may also feature deviations as mitigation against potential constraints. A similar assessment of constraints, including electrical design and landowner considerations, was undertaken to develop a shorter list of preferred options. These are shown in Figure 1.2. As with the export cable route and landfall, these potential route options will be further refined based on feedback from this scoping exercise and more detailed engineering, environmental and landowner assessments.

Figure 1.2 - Indicative onshore infrastructure options



1.6.8 Onshore Substation

The options for the location of the onshore substation are intrinsically linked to the need to be within 2 km of the existing NGET Pembroke 400 kV Substation. An initial review of electrical, environmental and landowner constraints has therefore been undertaken for a 2 km area surrounding the National Grid 400 kV Substation, resulting in 12 preliminary options being identified. These will be subject to a site selection process based on further studies, feedback from stakeholders, and the Scoping Opinion.

1.7 Consultation to Date

BGW, MarineSpace and ITPE have engaged in pre-application discussions with regulatory and statutory bodies at an early stage of the process to review project feasibility and consider issues associated with the proposed Project. Discussions have focused on consenting strategy, baseline environmental and socio-economic data, approach to ongoing consultation, project details and grid connection issues. Further stakeholder consultation, with statutory/non-statutory bodies and the public, will be undertaken throughout the EIA process. The stakeholder consultation undertaken for the Project builds on the extensive engagement that has been undertaken by BGW for Project Erebus.

A consultation log has been set up for Project Valorous and a summary of consultation to date is presented in Table 1.3.

Table 1.3 - Summary of consultation to date

Consultee	Dates	Purpose	Outcome
NRW Marine Advice Team	November 2020	Meeting and written advice on the survey scope for bird and marine mammals	Further pre-application and submit updated survey scope
Welsh Government, Planning Inspectorate,	December 2020	Meeting with Welsh Government and Planning Inspectorate to introduce the Project and discuss consenting requirements for the Section 36 Consent	Agreement on consenting approach for the proposed Project. BGW to request to invoke Regulation 39 in writing.
NRW Marine Licensing	December 2020	Written correspondence to introduce the Project and seek advice on consenting strategy	Agreement that a Marine Licence will be required for the proposed Project.
JNCC	December 2020	Meeting and written advice on the survey scope for bird and marine mammals	Further pre-application and submit updated survey scope
Welsh Government, Planning Inspectorate,	January 2021	Written request to invoke Regulation 39 to allow deferral of EIA considerations to NRW	Written confirmation that request to invoke Regulation 39 has been accepted. Deferral letter published on PINS website.
Pembrokeshire Coast National Park Authority, Pembrokeshire County Council, NRW	January 2021	To introduce the Project including consenting strategy	Raised awareness of the Project including delivery timescales

1.8 Scoping Opinion

It is requested that any correspondence relating to this Scoping Report and the request for a Scoping Opinion is directed to:

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2 Consents and Scoping

2.1 Introduction

The following section of the report provides details of the key project consents that will be required to construct and operate the proposed Project. Details are also provided of the key supporting documents needed to accompany any consent applications, including an ES, produced following the EIA process.

2.2 Consents to Install and Operate an Offshore Energy Installation

2.2.1 Consents Required

The following primary consents are required for the proposed Project:

- **Section 36 consent with deemed planning permission**, under the Electricity Act 1989, to construct and operate a generating station, with devolved powers under Section 39 of the Wales Act 2017; and
- **Marine Licence** under the Marine and Coastal Access Act 2009 (in force since 6 April 2011) to carry out certain activities in the marine environment, including construction works, depositing substances or articles, and dredging.

To support the primary consent applications, an EIA and Habitats Regulations Assessment (HRA) are required. Details of these aspects are provided in Section 2.3 and 2.4 respectively.

It is recognised that the UK left the European Union on the 31 January 2020. However, at the time of writing, all legal obligations regarding the compliance with environmental permitting and legislation continue to apply. This document is therefore produced in compliance will all existing, relevant EU and UK environmental legislation.

2.2.2 Consenting Authorities

2.2.2.1 *Section 36 Consent with Deemed Planning Permission*

Section 39 of the Wales Act 2017 devolves authority for the consenting of Section 36 (S.36) applications for offshore electricity generating stations up to and including 350 MW under the Electricity Act 1989 to Welsh Ministers. The actual start date for this devolved authority commencing was April 01 2019.

Prior to April 2019, projects of between 1-100 MW in Welsh waters were dealt with by the Marine Management Organisation (MMO), with projects greater than 100 MW dealt with by the Planning Inspectorate (PINS) via the Development Consent Order (DCO) process under the Planning Act 2008. At the time of writing, no application has yet been submitted to Welsh Ministers for a S.36 application. It is anticipated that BGW's demonstration project, Erebus, will be one of the first S.36 applications to go through the new process when submitted in December 2021.

S.36 applications are administered by PINS on behalf of Welsh Ministers and, following the appropriate consultation period, and hearings if necessary, the Inspector will submit their report to the Welsh Ministers for determination.

Planning permission can be deemed to be granted with a S.36 consent under Section 90(2) of the Town and Country Planning Act 1990 (as amended by S.21 of the Growth and Infrastructure Act 2013). This would result in a single consent being issued for the proposed

Project, plus the Marine Licence (issued by NRW Permitting Service Marine Licensing Team (NRW MLT)). For this option, PINS (on behalf of Welsh Ministers) would administer the process, with the Local Planning Authorities (LPAs), which in this case is Pembrokeshire County Council (PCC) and Pembrokeshire Coast National Park Authority (PCNPA), consulted. No separate application under the Town and Country Planning (Development Management Procedure) (Wales) Order would be submitted to PCC or PCNPA.

The Project intends, therefore, to follow the same consenting route as Project Erebus and submit a S.36 consent application with deemed planning permission (as well as a Marine Licence – see Section 2.2.2.2 below). This consenting strategy is subject to agreement through ongoing consultation and engagement with PINS, WG, NRW MLT, PCC and PCNPA.

Regulation 39 of The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2017 (as amended) permits deferral of EIA considerations in respect of S.36 consent application from Welsh Ministers to another EIA appropriate authority. In this case, it would be NRW MLT under the Marine Works (EIA) Regulations 2007 (as amended).

Following a request by BGW, the Welsh Ministers have invoked Regulation 39 of The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2017 (as amended) via a written notice issued on 11 January 2021. This has resulted in the deferral of EIA considerations, in relation to the S.36 Electricity Act 1989 application, from PINS to NRW.

2.2.2.2 *Marine Licence*

NRW MLT administers Marine Licence applications under the Marine and Coastal Access Act 2009 (MCAA) for licensable marine activities within Welsh inshore and offshore waters.

Prior to April 219, NRW MLT administered marine licences for projects within Welsh inshore waters out to 12 nautical miles (nm) only. The Wales Act 2017 transferred functions for marine licensing beyond 12 nm to the median line, from the MMO to Welsh Ministers. Subsequently, Welsh Ministers delegated this function to NRW MLT.

As set out in Section 2.2.2.1, NRW MLT will lead on the EIA for both the Marine Licence application and the S.36 consent, due to Regulation 39 having been invoked by Welsh Ministers.

2.3 Environmental Impact Assessment

The EIA Directive (2014/52/EU) requires that public and private projects that are likely to have significant effects on the environment, by virtue of their size, location or nature, be made subject to an assessment prior to consent being given. The following regulations transpose the EIA Directive (2014/52/EU) into UK legislation and apply to Project Valorous:

- The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2017 – applies to applications for S.36 consent under the Electricity Act 1989; and
- The Marine Works (EIA) Regulations 2007 (as amended) – applies to applications for a Marine Licence under the Marine and Coastal Access Act 2009.

Under both sets of EIA Regulations, Project Valorous would be considered as a Schedule 2 development requiring screening to identify if EIA is required. Schedule 1 developments, however, will always require EIA.

A separate EIA Screening Request has not been submitted for Project Valorous, however this report is intended to act as a submission for both an EIA Screening and Scoping

Request. It is currently anticipated that an EIA will be required as defined in the EIA Regulations and due to the Project type, scale and location:

- ***1.*** *Development to provide a generating station (other than a generating station of a description set out in paragraph 1 of Schedule 1)* under Schedule 2 of The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2017
- ***21.*** *Installations for the harnessing of wind power for energy production (wind farms)* under Schedule A2 of The Marine Works (EIA) Regulations 2007 (as amended)

A copy of this EIA Scoping Report has been submitted to PINS, for deferral to NRW MLT for the S.36 consent and a copy submitted to NRW MLT for the Marine Licence application.

Details of the proposed methodology for the EIA are provided in Section 3. This section also includes details of the 'project envelope' approach to assessment that will be adopted in the EIA. This approach, which is well-established for EIAs of offshore renewable projects, ensures that the worst-case scenario is assessed for each EIA topic.

With respect to relevant EIA guidance, the EIA that will be undertaken will take full account of key policies, legislation, guidance and advice, including but not limited to the following:

- Environmental Impact Assessment for Offshore Renewable Energy Projects – Guide, 2015. Report PD6900:2015. Prepared by ABPmer on behalf of The British Standard Institution (BSI). ISBN 978 0 580 87163 4;
- Ministry for Housing, Communities and Local Government (MHCLG) "Guidance: Environmental Impact Assessment" (2017);
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU) (European Union, 2017);
- Institute of Environmental Management & Assessment (IEMA) "Guidelines for Environmental Impact Assessment" (2017);
- Planning Policy Wales (2018);
- Welsh National Marine Plan (2019);
- Future Wales: The National Development Framework [currently in development]; and
- NRW Marine and Coast guidance, including GN013 Guidance on Scoping an Environmental Impact Assessment for marine developments (2017); and
- The Wildlife and Countryside Act 1981.

2.4 Nature Directives and Habitats Regulations Assessment

The aims of the EC Habitats Directive (Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora) and Birds Directive (2009/147/EC) are to maintain or restore European protected habitats and species; contribute to a coherent European ecological network of protected sites by designating Special Areas of Conservation (SACs) and Special Protection Areas (SPAs); and ensure appropriate assessment of plans and projects likely to have a significant effect on the integrity of an SAC/SPA.

As a matter of UK policy, internationally designated wetland sites, Ramsar sites, are also considered through the HRA process.

The UK has transposed the Directives into law through a series of regulations, referred to as the Habitats Regulations. Those relevant to Project Valorous are:

- The Conservation of Habitats and Species Regulations 2017 (apply to terrestrial and territorial waters out to 12 nm); and

- The Conservation of Offshore Marine Habitats and Species Regulations 2017 (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).

Following the UK's exit from the EU and end of transition period on the 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 Regulation (above) 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 that have been applied are expected to provide legal certainty and minimise disruption immediately following EU exit. Legislation has been maintained as closely as possible to that which was already in place, to ensure the Regulations continue to have the same working effect following the UK's exit from the EU. Overall, the legislative changes do not result in material changes in how HRAs are undertaken in the UK.

References to "European sites" and "Natura 2000 sites" throughout this report, are to be read as references to "European sites within the UK national site network, (as defined by Regulation 3 of the Conservation of Habitats and Species Regulations 2017)" designated before the UK left the EU or designated after the UK left the EU under transposing regulations (Defra, 2020).

Due to the proximity of European Sites to the Project Valorous site, a HRA will be required to assess whether the project will have a likely significant effect on the integrity on any European site, either individually or in combination with other plans or projects. Where a significant effect cannot be excluded beyond reasonable scientific doubt at the Screening stage, an Appropriate Assessment will be required to assess the implications of the proposed Project on the site's conservation objectives.

To undertake the HRA as required by the Regulations, it is the developer's responsibility to provide the competent authority with such information as may reasonably be required "*for the purposes of the assessment*" or "*to enable them to determine whether an appropriate assessment is required*" (EC, 2018). The relevant competent authorities are NRW MLT for the Marine Licence and the Welsh Ministers, administered by PINS, for the S.36 consent.

Further details of the proposed approach to the HRA process are provided in Section 3.13.

2.5 Water Framework Directive Compliance Assessment

The Water Framework Directive (WFD) 2000/60/EC provides protections to transitional and coastal water bodies, with the aim of achieving good overall status. WFD water bodies can extend out to 1 nm, and out to 12 nm in respect of chemical status.

Project proposers must demonstrate that the project will not cause "deterioration in the water body". This is documented through a WFD Compliance Assessment. The WFD Compliance Assessment is a 3 stage process which includes:

1. Screening: to determine if the activity or project needs to progress to the scoping stage or if it is excluded from further assessment;
2. Scoping: to identify the potential risks from the activity or project on receptors (hydromorphology; habitats; fish; water quality; and protected areas) as well as consideration of invasive non-native species; and
3. Impact assessment: consideration of the impacts to each receptor identified in the scoping stage and the level of impact. This stage should also consider any proposed mitigation to avoid or reduce impacts.

A WFD Compliance Assessment is separate from the EIA. However, environmental assessments should be coordinated with the EIA process.

2.6 Secondary Consents and Additional Approvals

In addition to the primary consents, the following secondary consents and approvals are likely to be required for the Project:

- **Declaration, pursuant to Section 36A of the Electricity Act** to extinguish public rights of navigation where the FLOW structures are located;
- **Safety Zone application** as set out in the Energy Act 2004 and under the amendments to The Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007 introduced by The Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) (Amendment) (Wales) Regulations 2019;
- **European Protected Species Derogation Licence** issued under the Conservation of Habitats and Species Regulations 2017 to undertake works that may affect European Protected Species (EPS) administered by NRW;
- **Site of Special Scientific Interest (SSSI) Consent / Assent** for works that may affect an SSSI, administered by NRW;
- **Milford Haven Port Authority (MHPA) Marine Works Licence** for any installation works within MHPA jurisdiction.

Other additional consents that may be required include:

- Electricity Generation Licence from Ofgem;
- Grid connection agreement with either Western Power Distribution or National Grid Transmission;
- Operational agreements with MoD or other relevant landowner;
- Wayleave and / or Deed (land transfers, leases or easements) agreements with landowners to install, replace and maintain equipment;
- Notification procedure under the New Roads and Street Works Act 1991, with the relevant highway authority; and
- Environmental Permits, e.g. for flood risk activities.

2.7 Co-ordination of Consenting

It is the intention of BGW to twin track the submission of the application for S.36 consent with deemed planning permission, with the Marine Licence application. Both submissions will be supported by one ES, covering offshore and inshore marine, coastal and terrestrial environments.

It is understood that a submission will be made to PINS for the S.36 with deemed planning and NRW for the Marine Licence. Each will be accompanied by a single ES, although NRW will lead on the processing of the EIA. Each submission will also be accompanied by sufficient information for both competent authorities to undertake a HRA.

The ES will include sufficient information to meet the requirement of the following:

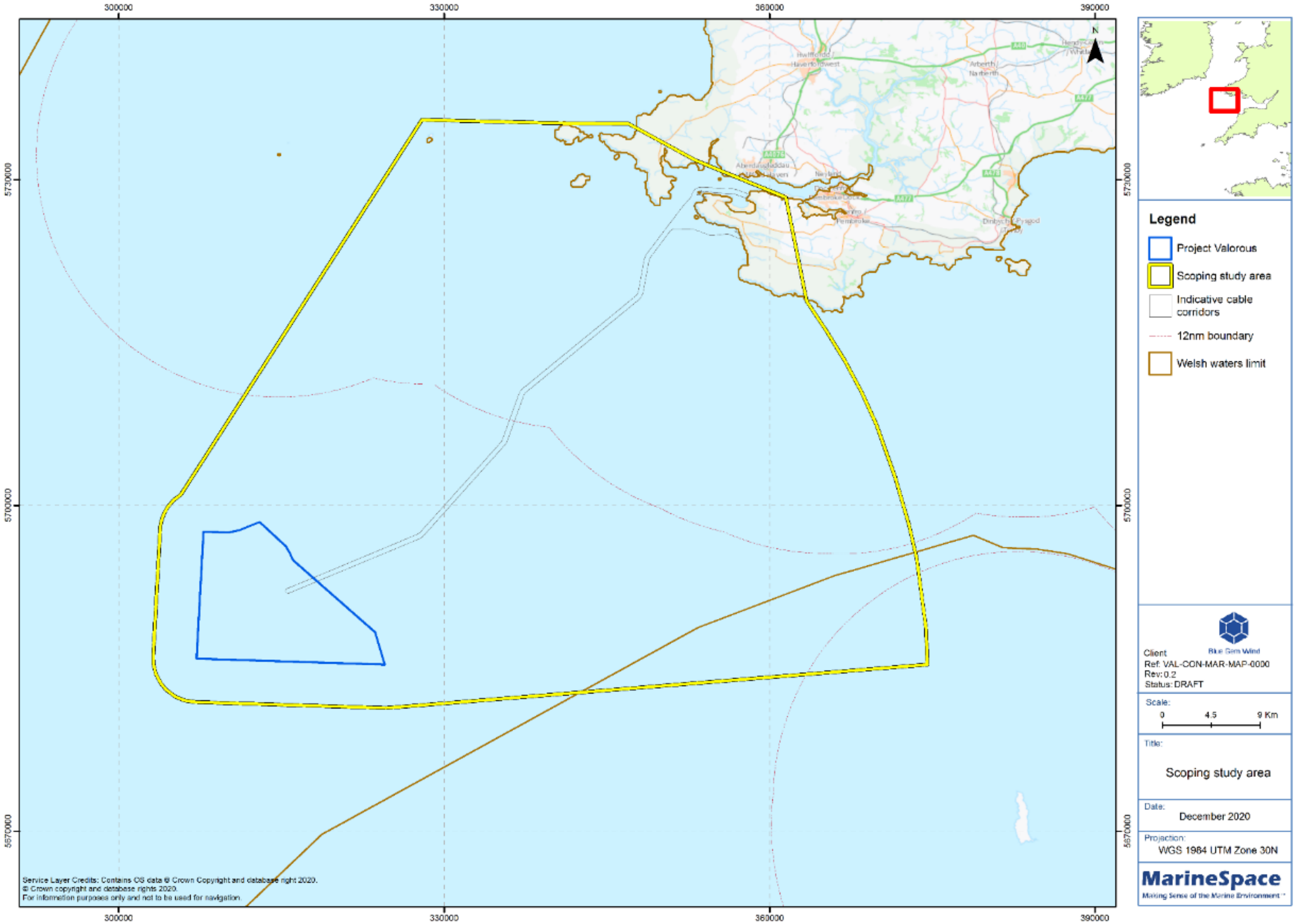
- The Conservation of Habitats and Species Regulations 2017 (as amended) and associated Regulations: Recognising any impacts arising from the proposed development on European Protected Specieand requirement for derogation licences;
- Water Framework Directive (WFD): submission of a WFD Compliance Assessment to assess potential impacts on WFD waterbodies;
- Marine and Coastal Access Act 2009: In respect of a Marine Licence and potential impacts on Marine Conservation Zones;
- UK Marine Policy Statement: submission will be in accordance with the policies set out in the UK Marine Policy Statement;
- The Well-being of Future Generations (Wales) Act 2015: To provide a framework for the consideration of social, economic, environmental and cultural impacts on the well-being of Wales, climate change being integral to those goals;
- The Environment (Wales) Act 2016: Recognition of policy and area statements to reflect the priorities and opportunities for Wales' natural resources;
- Planning Policy Wales: Recognition of current planning policy set out in PPW 10;
- Welsh National Marine Plan (WNMP): submission will be in accordance with the policies, including a compliance assessment for the Project with the policies, to ensure marine resources are used in a sustainable way in line with the high-level marine objectives;
- Local Development Plans (LDPs):
    - Pembrokeshire County Council Local Development Plan - PCC Local Development Plan, 2013 will be referred to for any terrestrial elements of the proposed scheme, within PCCs jurisdiction;
    - Pembrokeshire Coast National Park Local Development Plan - works, within the jurisdiction of PCNPA, will be in accordance with the relevant LDP policies; and
- Relevant Welsh Area Statements developed by NRW: Using the themes in the Marine Area Statement and South West Area Statement.

2.8 Scoping Study Area

Figure 2.1 shows the overarching study area upon which this Scoping Report is based. This area includes the area of interest of the FLOW development, including a 4 km seaward buffer to the south and west. The offshore study area extends beyond the scope of the proposed offshore cable routes to encompass a large search area that has been applied in screening alternative cable routes and landfall sites. The offshore study area also reflects the geological study area used in early feasibility studies.

For certain EIA topics, the EIA Scoping Study Area is different to that shown below. Where this is the case, the extents of these scoping Study Areas are provided in each section of the report

Figure 2.1 - Project Valorous scoping study area



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3 Proposed Approach to Environmental Impact Assessment

3.1 Introduction

This section sets out the general approach and methodology to the EIA process for the proposed Project. It draws on key relevant EIA guidelines and best practice (e.g. BSI, 2015; IEMA, 2016; EU, 2018; NRW, 2017; CIEEM, 2018). The proposed approach is intended to ensure the EIA and the final ES are fit-for-purpose (focused, proportionate and effective) as a tool to aid the consent decision-making process. This includes the approach that will be used to identify, evaluate and mitigate the environmental effects of the proposed Project, as well as ensuring that the EIA core findings are clearly presented in the ES.

This will enable the Regulatory bodies to come to reasoned conclusions on the likely significant effects of the proposed Project as part of their decision-making processes. A list (albeit not exhaustive) of relevant EIA guidance that will be used throughout the EIA process is provided in Section 2.3.

Amendments to the Marine Works EIA Regulations in May 2017 have placed a greater emphasis on the identification of the 'likely significant effects' of proposed projects at the earliest possible stage, so that the EIA can take a focused and proportionate approach. The underlying principle of the EIA Regulations is to streamline assessments and limit their scope to those aspects of the environment that are likely to be significantly affected.

To streamline the EIA and ES for the proposed Project, they will be based on these principles:

- Only environmental information that is relevant, necessary and material to the decision or to address issues raised by stakeholders will be provided in the ES;
- Whilst the ES will provide a full factual description of the proposed development and its effects, the emphasis will be on the main or significant environmental effects to which the Project is likely to give rise;
- Impacts which have little or no significance will have only a very brief treatment to indicate that their possible relevance has been considered; and
- Conclusions about significant or non-significant effects in the ES will be supported by reasoning and evidence. The depth of this evidence will vary across issues and receptors.

3.2 Project Phases

The EIA will consider the activities carried out within the 3 distinct phases of the proposed Project:

1. **Construction**: Offshore construction includes installation of WTGs and foundations / moorings, offshore electrical infrastructure including offshore substation, inter-array cables and export cable. Onshore construction includes cable landfall, the onshore cable, and an onshore substation near Pembroke Power Station;
2. **Operation**: Presence and operation of floating offshore WTGs and associated infrastructure, including maintenance activities for a duration of 25 years; and
3. **Decommissioning**: Decommissioning and removal of WTGs and on- and offshore infrastructure. The most appropriate approach to Project decommissioning will be

decided nearer the end of the Project lifetime, to ensure approaches are based on best practice and best available evidence. In some cases, it may be less damaging to the environment, or a preferred option, to leave some infrastructure *in situ* rather than removing entirely.

3.3 EIA Process

This EIA Scoping Report presents the conclusions of the preliminary scoping exercise for the proposed Project. It sets out those environmental issues that will be considered in the EIA, the assessment approach and the likely depth of evidence required to inform the assessment of each of the identified effects. This report also identifies those environmental effects for which it is suggested that no further consideration is necessary, either because they are unlikely, or because they are not likely to be of significance in their magnitude, duration or impact (i.e. no likely significant effects can be determined at the scoping stage). Further consideration is given to assessing significance and the distinction between significant and non-significant effects in Section 3.8.

The impact assessment itself will be an iterative process, featuring scoping as a core ongoing activity, refining understanding for the proposed Project's likely significant effects, and defining what information is of relevance and value. This iterative process will 'scope down / out' or 'retire' issues that are not likely to result in significant environmental effects and ensure that the EIA process identifies and focuses on the issues that may result in significant effects. It will also ensure that the ES presents an appropriate and proportionate depth of evidence on the environmental effects of the Project in a format that is accessible. Table 3.1 sets out the components of a proposed iterative EIA for the Project.

Table 3.1 - Components of the proposed iterative EIA for Valorous

Component	Detail
Regulator and Stakeholder Consultation	Clear and focussed consultation with various parties, at key stages in the assessment process to address key concerns and identify key data gaps.
Scoping	Initial scoping study to identify the potentially significant direct and indirect likely effects of the Project and Cumulative Impact Assessment (CIA). Initial assessment of the depth of evidence required for EIA topics and, where relevant, need and scope of additional project-specific surveys.
Evidence Collection and Collation	Required to characterise the existing environment and gather appropriate data to enable an assessment of the environmental effects of the Project. EIA evidence collection and collation will include review and use of existing data and evidence, as well as project-specific survey activity to gather additional information or data, if necessary. This will likely also include project-specific specialist studies to provide further information on key parameters which may be affected by the project or on key impact pathways. These could include studies to predict changes to the physical environment as well as biological and human receptors.

Component	Detail
	Nature and depth of evidence to assess the environmental effects of the Project are indicated in Chapters 5-7 but will be part of the iterative EIA process. This review will be based on the findings of initial baseline studies, the assessment of effects and consultation with regulatory authorities and other stakeholders
Impact Assessment	Evaluation of the existing environment, definition of receptors (including their sensitivity – tolerance, adaptability and recoverability). Evaluation and prediction of the potential positive and negative impacts of the Project on the receiving environment plus assessment of the likely significance of the effects. The impact assessment will consider interactions between the Project and existing activities and interactions between environmental topics. It will also identify any monitoring programs needed to verify the predicted effects and the effectiveness of mitigation measures to allow an Adaptive Environmental Management Process (AEMP) to be followed where appropriate.
Mitigation and Optimisation including Project Design Refinement	Where significant adverse effects are identified, mitigation measures will be proposed, designed to eliminate or ameliorate these effects to acceptable levels. Any required design changes and / or practical mitigation measures to avoid, reduce or offset likely significant effects will be considered and fed back into the Project Design Envelope (i.e. through an Adaptive Environmental Management Plan (AEMP) process). The EIA will also identify proposed monitoring procedures to keep under systematic review any significant adverse effects on the environment resulting from the construction and operation of the Project, as well as to identify unforeseen significant adverse effects, in order to be able to undertake appropriate remedial action where required.
Determination of Residual Effects	The likely significance of effects that remain after implementation of design optimisation and mitigation measures will be assessed (residual effects). The level of certainty associated with proposed mitigation measures both in terms of delivery and effectiveness will be considered as part of this stage.
Cumulative Impact Assessment	The potential for the effects of the Project to interact cumulatively with those of other planned projects to result in likely significant effects will be assessed. If necessary additional optimisation, mitigation or monitoring would be identified to avoid or reduce potentially significant cumulative effects.
Inter-Related Effects	An assessment will be made of the potential for individual effects to interact together to create likely significant effects.
Production of Environmental Statement	An ES will be produced to document the findings of the EIA as a tool to inform decision-making, in a format that is accessible to stakeholders. The ES will include a Non-Technical Summary (NTS).

As well as being iterative, the EIA process will be outcome led, whereby:

- The ES will be based around a clear narrative, setting out the key conclusions and messages of the EIA, backed up by a clear evidence-based rationale;
- Topic assessments will focus on delivering clarity and confidence in the key messages they need to deliver via the EIA process and ES presentation;
- Any likely significant effects identified are reliable and backed up by the right compelling evidence for the topic or subtopic's key stakeholders;
- Any mitigation is clearly explained as to why it is capable and sufficient to manage the identified likely significant effects;
- Other impacts are clearly and concisely presented, aside from any likely significant effects; and
- The assessment provides all interested stakeholders with confidence that any mitigating actions will be delivered.

3.4 Project Envelope

At this stage, there are uncertainties associated with the final Project description and parameters. The EIA will address this uncertainty by ensuring that for each EIA topic, the 'realistic worst-case' scenario is clearly identified and described and used as the basis of all assessments. The ES will provide a clear explanation of the potential impact of each of the different scenarios. This approach aligns with NRW guidance on scoping and the use of Project Design Envelopes (PDE) for marine projects (NRW, 2017).

This is done by ensuring that the scenario that would have the greatest impact, for example the largest footprint of project infrastructure on seabed; highest blade tip height / diameter of WTGs etc., is fully assessed for each EIA topic. Adopting this approach enables an assumption to then be made, that if impacts from the worst-case scenarios were acceptable (in EIA terms), then any impacts from scenarios with lesser / lower values would also be acceptable.

Scoping, and the ongoing process throughout EIA of refining the evidence base on the likely significant effects of the Project, will inform understanding for those parameters of the design envelope most likely to influence the magnitude of the significant impacts of the Project. It is likely that some design parameters will need to be tightly defined, where the potential for impacts on sensitive receptors is significant. Other Project parameters may be more benign in their potential to cause significant effects, such that greater flexibility in the design envelope may be retained.

The worst-case scenarios for each EIA topic will be presented at the start of each chapter of the ES, so that the basis of the assessment is clear. An overall PDE spreadsheet will be developed and populated with all key parameters and values. This will form the basis for determining the worst-case values for each chapter and for identifying any relationship between impact pathways, envelope parameters and worst-case scenarios, to ensure a holistic assessment. In order to future-proof the assessment, the PDE will contain values for technologies that may not yet be fully developed but are expected to potentially form part of the proposed Project infrastructure by the time of construction.

This approach is particularly advantageous for developments, including Offshore Wind Farms (OWF), where it is not possible to identify the exact components to be used within the final development; as it provides for flexibility in design and construction within maximum extents and ranges assessed within the EIA. Therefore, the consent permits the use of any components so long they are within the maxima assessed, rather than limiting the development to existing technology at the time of assessment, which may not be economically viable or available at the point of construction.

3.5 Approach to Assessing Interactions with Existing Activities

The potential for interactions between the effects of the proposed Project and existing pressures and activities on sensitive receptors will be considered in the EIA. Current activities form part of the baseline environment. Their effect on the current status of a receptor (e.g. the conservation status of a habitat or species, or the economic status of an existing sector or industry) will be described in the baseline sections of the relevant topic chapters. The sources of baseline information and evidence of relevance to existing activities and receptors, have been summarised in Sections 5 to 8 of this document.

3.6 Approach to Interactions between Environmental Topics

The impact assessment will consider how effects on individual environmental receptors may interact to generate new effects or alter the magnitude of impacts. The EIA will first consider the potential effects of the proposed Project on environmental receptors individually, before identifying, evaluating and assessing any linkages and relationships. The effect of any interactions on likely significance of effects will be considered, along with possible need for additional mitigation measures and any resultant residual effects. The final assessment of effects will take account of the identified interactions.

3.7 Transboundary Assessment

The EIA will consider all areas and receptors that could be directly or indirectly affected by the Project, irrespective of administrative boundaries. Potential effects on transboundary receptors will therefore be an integral component of the relevant topics for the environmental assessment.

The Zone of Influence (ZoI) for the Project, and therefore the geographical scope of the impact assessment including any necessary transboundary assessment, will vary across receptors. The potential ZoI of the Project is likely to be greatest for wide-ranging mobile or migratory species (e.g. some species of seabirds and marine mammals) as well as shipping and commercial fisheries. The ZoI and the spatial scale of assessment for receptors, including transboundary assessment, is considered in Sections 5 to 8 of this report.

3.8 Assessing Significance

The determination of significance is fundamental to determining the requirement, breadth and scope of EIA, and is the primary method for communicating information related to environmental effects. However, significance is a subjective judgement without legal definition or relevant guidelines. It will be important to have consistency and transparency in the process by which the significance of effects is assessed in the EIA and that this is clearly and effectively documented within the ES.

To date, guidance has not been produced by the UK and Welsh Governments on defining 'likely significant effects' particularly in the context of the amendments to the EIA Regulations in 2017. A series of principles has therefore been developed, drawing on recognized EIA guidance and technical guidelines (BSI, 2015; IEMA, 2016; EU, 2017; CIEEM, 2018) and further informed by discussions relating to the development of a proportionate EIA strategy for the UK (IEMA, 2017).

These principles provide the framework around which judgements on 'likely significant effects' will be based throughout the EIA process for the proposed Project:

- The assessment of significance will take account of the regulatory context, environmental consequences, and stakeholder expectations in determining the overall consequences of effects;

- A likely significant effect is a potential effect that may be a reasonably predicted consequence of the project;
- A likely significant effect may be positive or negative in its consequences for a receptor;
- Trivial or inconsequential effects are not significant;
- The assessment of significance of effects will consider the extent, magnitude, duration and reversibility of the effects and the sensitivity of the receptor (as determined through the interactions of receptor's tolerance, adaptability and recoverability to each effect);
- A significant ecological effect is one that either supports or undermines biodiversity conservation objectives for 'important ecological features'; and
- The assessment of likely significance of effects will consider mitigation measures (i.e. residual significance of effects).

The EIA process will use a combination of approaches to use the best available evidence to assess the significance of effects. This is likely to include use of traditional significance ranking matrices, such as the approach presented in Table 3.2 a-c, (based on approaches set out in CIEEM, 2018 and SNH,2018), as well as narratives based on organised reasoning and expert judgement[2].

Table 3.2. a-c - Example of a traditional matrix-based approach to assessing the significance of effects in Environmental Impact Assessment, combining receptor sensitivity with impact magnitude (CIEEM, 2018; SNH,2018)

a. Sensitivity Levels for Environmental Receptors.

Sensitivity	Description
High	Receptor has very limited capacity to avoid, adapt to, accommodate or recover from the anticipated impact.
Medium	Receptor has limited capacity to avoid, adapt to, accommodate or recover from the anticipated impact.
Low	Receptor has some tolerance to avoid, adapt to, accommodate or recover from the anticipated impact.
Negligible	Receptor is generally tolerant to and can accommodate or recover from the anticipated impact.

b. Guidelines for Determining Magnitude Levels for Environmental Impacts

Magnitude	Description
High	Loss of resource, but not affecting integrity of the resource; partial loss of or damage to key characteristics, features or elements (adverse). Permanent / irreplaceable change, which is likely to occur. Improvement to, or addition of, key characteristics, features or elements of the resource; improvement of attribute quality (beneficial).

[2] Regulation 12(2) of the Marine Works Regulations (as amended 2017) explicitly requires developers to use 'competent persons' to undertake the EIA.

Magnitude	Description
Medium	Minor loss of, or alteration to, one (or maybe more) key characteristics, features or elements; measurable change in attributes, quality or vulnerability (adverse). Long-term though reversible change, which is likely to occur. Minor improvement to, or addition of, one (maybe more) key characteristics, features or elements of the resource; minor improvement to attribute quality (beneficial).
Low	Very minor loss of, or alteration to, one (or maybe more) key characteristics, features or elements; noticeable change in attributes, quality or vulnerability (adverse). Short- to medium-term though reversible change, which could possibly occur. Very minor improvement to, or addition of, one (maybe more) key characteristic, feature or element; very minor improvement to attribute quality (beneficial).
Negligible	Temporary or intermittent very minor loss of, or alteration to, one (or maybe more) characteristic, feature or element; possible change in attributes, quality or vulnerability (adverse). Short-term, intermittent and reversible change, which is unlikely to occur. Possible very minor improvement to, or addition of, one (maybe more) characteristic, feature or element; possible improvement to attribute quality (beneficial).

c. Impact Assessment Matrix, Combining Receptor Sensitivity with Impact Magnitude.

		Negative Magnitude				Beneficial Magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Minor	Minor	Minor	Moderate	Major
	Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

Where a traditional matrix-based approach is deemed appropriate for assessing the significance of environmental effects within the EIA, the above definitions will be used. Where more bespoke approaches to defining receptor sensitivity and environmental impact magnitude are required, modified versions of the above will be used. Full details of the topic-specific assessment methodology will be set out in each individual ES chapter.

3.9 Mitigation and Monitoring

Where an impact assessment identifies that an aspect of the project is likely to give rise to significant environmental effects, mitigation measures will be proposed, in order to avoid impacts or reduce them to acceptable levels.

Mitigation will take place in the following hierarchy, where the first is not feasible due to constraints, including, engineering, technology or geology, the next measure will be engaged.

1. The proposed Project design will aim to avoid placing permanent infrastructure or having temporary working areas within protected sites, where possible;
2. If avoidance of protected sites is not possible, best endeavours will be made to design the proposed Project to avoid direct impact on the specified features of interest within protected sites via specific construction and decommissioning methods, where possible;
3. Where the feature is not static, the design of the infrastructure of the proposed Project must, where practicable, minimise impact on mobile species or features, therefore reducing the interaction and harm; and
4. Where avoidance of features of interest are not possible, mitigation measure will be developed for construction, operation and decommissioning to minimise effects, such as work schedule, techniques and working areas, and agree reinstatement of temporary works with regulatory authorities, offsetting or enhancement measures.

It is important to note that the mitigation measures applied should be proportionate to the scale of the impact predicted. Appropriate mitigation measures will be discussed and agreed, where possible, with the relevant regulatory authorities and stakeholders.

In some cases, in order to ensure that the mitigation measures are successful or where there is significant uncertainty with respect to important receptors, monitoring may be appropriate. Monitoring programmes are most commonly required during and shortly after construction, but can also be prior to and during operations. The nature of any monitoring will be dependent on the nature of the effect or mitigation measure under inspection.

3.10 Structure of the Environment Statement

The structure and format of the ES will be finalised during the EIA, to ensure that it adds value to the consenting process[3]. The final format of the ES will be such that it provides stakeholders with clear accessible information on the likely effects of the Project that are relevant, necessary and material to the decision, or where it is required to address issues raised by stakeholders throughout the consultation process. Table 3.3 sets out the proposed structure of the Project Valorous ES.

Table 3.3 - Proposed structure for the project Environmental Statement

Volume	Document Title
	Non-Technical Summary
Volume 1 - Chapters	SECTION 1 – Introductory Chapters
	Chapter 1: Introduction
	Chapter 2: Overview of EIA methodology
	Chapter 3: Site Selection and Alternatives
	Chapter 4: Proposed Development Description
	Chapter 5: Policy and Legislation

[3] The ES structure will be compliant with the requirements of Regulation 21A.((2)(a)-(e)) of the Marine Works Regulations (as amended 2017)

Volume	Document Title
	SECTION 2 – Offshore Chapters
	Chapter 6: Marine and Coastal Processes
	Chapter 7: Marine Seabed and Water Quality
	Chapter 8: Offshore Designated Sites
	Chapter 9: Marine and Coastal Ecology
	Chapter 10: Fish & Shellfish Ecology
	Chapter 11: Offshore Ornithology
	Chapter 12: Marine Mammals and Reptiles
	Chapter 13: Seascape and Visual Impacts
	Chapter 14: Underwater Noise and Vibration
	Chapter 15: Offshore Archaeology and Cultural Heritage
	Chapter 16: Commercial Fisheries
	Chapter 17: Shipping and Navigation
	Chapter 18: Aviation and Radar
	Chapter 19: Coastal and Marine Infrastructure and Other Users
	SECTION 3 – Onshore Chapters
	Chapter 20: Onshore Geology, Hydrogeology and Hydrology
	Chapter 21: Terrestrial and Coastal Ecology
	Chapter 22: Onshore Ornithology
	Chapter 23: Landscape and Visual Impacts
	Chapter 24: Onshore Noise and Vibration
	Chapter 25: Onshore Archaeology and Cultural Heritage
	Chapter 26: Land Use
	Chapter 27: Traffic and Transport
	Chapter 28: Air Quality
	SECTION 4 –Overview Chapters
	Chapter 29: Socio-economics, Tourism and Recreation
	Chapter 30: Climate Change, Major Accidents and Natural Disasters
	Chapter 31: Inter-related Effects
	Chapter 32: Cumulative Effects
	Chapter 33: Summary of Residual Effects

Volume	Document Title
Volume 2 – Figures	All figures
Volume 3 – Technical Appendices	Technical appendices to supplement information in other Volumes, as necessary
Volume 4 – Confidential Technical Appendices and Figures	Confidential technical appendices and figures

Table 3.4. Further Consent Application Supporting Documentation

Document Title	Description
Consultation Report	Submitted with planning application and included in the ES as a technical appendix
Planning Statement	And associated plans
HRA Screening Report	Submitted with planning application and included in the ES as a technical appendix
Habitats Regulations Assessment	Report to inform Appropriate Assessment (RiAA). Submitted with planning application and included in the ES as a technical appendix
Water Framework Directive Assessment	Submitted with planning application and included in the ES as a technical appendix

Each topic chapter will include a description of the approach to impact assessment used, including any bespoke approaches. This will include an outline of consultation undertaken, evidence incorporated and the means of defining the area of search or ZoI for that topic. Any technical deficiencies or difficulties encountered in compiling the required information will be noted and commentary provided on how uncertainty may influence the impact assessment. The existing baseline conditions for the topic will be described and assessment will then be made of the nature, magnitude, duration and significance of the likely effects of the construction, operation maintenance and decommissioning of the proposed Project on the topic.

Mitigation measures to avoid, minimise, or remedy the predicted impact, where practical, will be outlined and assessment will be made of the significance of the likely residual effect following monitoring and mitigation.

The Marine Works (EIA) Regulations 2007 (as amended) set out the information that must be included within the ES. The ES structure will be compliant with the requirements of Regulation 21A.((2)(a)-(e)) of Regulation which state the ES must include, at a minimum:

- A description of the likely significant effects of the project, whether direct, indirect, secondary, cumulative, transboundary, short-term, medium-term, long-term, permanent, temporary, positive and negative.
- A description of the methods used to make the assessment of the significant effects and difficulties encountered in compiling the information, and uncertainties involved.
- A description of measures to avoid, prevent, reduce or offset identified significant adverse effects, and proposed monitoring arrangements.
- A description of the expected significant adverse effects of the project on the environment resulting from the vulnerability of the project to risks of major accidents or disasters

3.11 Vulnerability to Climate Change Natural Disasters or Major Accidents

The 2017 amendments to the EIA Regulations require that the EIA considers the vulnerability of the proposed Project to climate change, natural disasters and major accidents. This assessment will be included within the EIA; either incorporated into topic chapters, or in a separate section. The scope of this assessment will be informed by advice from NRW and the LPAs on the nature and scope of natural disasters and major accidents it would advise are relevant the Project.

3.12 Overall approach to Other Environmental Assessments

Where other environmental assessments are required for the Project, such as HRA and Water Framework Directive (WFD) compliance assessment, these will be coordinated with the EIA process. However, it is important to note other environmental assessments are separate processes to the EIA and as such will be documented clearly and signposted to within the ES.

3.13 Approach to Habitats Regulations Assessment

3.13.1 Nature Directive and UK Regulations

As set out in Section 2.4, the requirements of the EC Habitats Directive, the Birds Directive, and the Convention on Wetlands of International Importance, also known as the Ramsar Convention, are transposed into UK legislation through the Habitats Regulation. This includes amendments from the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019. The aim of the Habitats Directive is to conserve natural habitats and wild species across Europe by establishing a network of sites known as Natura 2000 sites.

For the purpose of this Scoping Report, Natura 2000 sites are referred to as European site(s), or European marine site(s) where the site exists below the highest astronomical tide (HAT) within the UK's National Site Network.

Under Article 6(3) of the Habitats Directive, for any proposed plan or project, which is not directly connected or necessary to the management of the European marine site, competent authorities[4] should make an initial consideration, in consultation with relevant Statutory Nature Conservation Bodies (SNCB), to establish whether the plan or project is likely to have a significant effect on the European marine site.

"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to Appropriate Assessment of its implications for the site in view of the site's conservation objectives" - Article 6(3).

Article 6(3) has been interpreted as meaning that any project is to be subject to an appropriate assessment (AA) if it cannot be proven, beyond reasonable scientific doubt, that there is no likely significant effect on that site (a precautionary approach), either alone, or in combination with other plans or projects[5].

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[4] "Competent Authority" as defined by the 2017 Habitats Regulations 7(1), is a Minister of the Crown, government department, statutory undertaker, public body of any description or person holding a public office, Welsh Minister and is any such body with authority to give consent, or with authority to undertake projects themselves. The competent authority must ensure the requirements of the Habitats Regulations are met before undertaking or permitting any plan or project. Regulation 63 of the 2017 Habitats Regulations (as amended) and Regulation 25 of the Offshore Marine Regulations.

[5] Decision of the ECJ in Waddenzee (C-127/02) – determined that in light of Article 6(3) of the Habitats Directive, a probable risk of significant effect of a plan or project exists (in particular, in view

Should an AA conclude there will be an adverse effect on the integrity of a site, a project cannot proceed unless the requirements from Article 6(4) derogations are met. These are the test of alternative solutions and then imperative reasons of overriding public interest (IROPI). If it is decided a project meets the requirements of Article 6(4), compensations measures are required to be delivered to "*ensure the overall coherence of the Natura 2000 network is protected."*

The protection given by the Habitats Directive is transposed into UK law by regulations related to different consenting regimes, known as the 'Habitats Regulations'. The relevant Habitats Regulations are:

- The Conservation of Habitats and Species Regulations 2017 (as amended) (applies to terrestrial and offshore waters out to 12 nm);
- The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) (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).

The Habitats Regulations require the competent authority, before deciding to authorise a project which is likely to have a significant effect on a European site "*to make an Appropriate Assessment of the implications for that site in view of that site's conservation objectives*"[6].

In accordance with the Habitats Regulation 63(2), anyone applying for consent must provide the competent authority with such information as may reasonably be required "*for the purposes of the assessment*" or "*to enable it to determine whether an Appropriate Assessment is required*"[7].

Sites of Community Importance, afforded protection under the 2017 Habitats Regulations, are designated in the UK as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). As a matter of policy, the devolved Governments also apply the procedures described below to Ramsar sites, possible SACs, candidate SACs and potential SPAs.

3.13.2 The Role and Requirements of the Competent Authority

Although the 2017 Habitats Regulations do not specify the methodology for carrying out an HRA, they do specify the obligations of the competent authority, NRW and Welsh Ministers in this respect, and the applicant. The role of the competent authority is to determine if there are likely significant effects and carry out the AA[8], if required, before a decision is made. The competent authority is also required to consult with the relevant SNCBs, in this case NRW and JNCC (and the public, if considered appropriate), before deciding to give consent. Where adverse effects remain, the competent authority must undertake further assessments on alternatives and prepare a justification statement for Imperative Reasons of Overriding Public Interest (IROPI).

It is the responsibility of the applicant to include 'sufficient information' with the ability to identify the European sites within the UK National Site Network, including European marine sites, and

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of the precautionary principle) if such a risk cannot be excluded on the basis of objective information that the plan or project will have significant effects on the site concerned.

[6] Regulation 63 of the 2017 Habitats Regulations and Regulation 28 of the Offshore Marine Regulations.

[7] Regulation 63(2) of the 2017 Habitats Regulations and Regulation 28(2) of the Offshore Marine Regulations,

[8]The 2017 Habitats Regulations 63(1)

to enable an AA to be made if required[9]. This is the rationale for a Report to Inform an AA (RiAA).

3.13.3 The Habitats Regulations Assessment Approach

The approach to the Habitats Regulations Assessment (HRA) process has followed that set out in '*Planning Circular 06/2005 on Biodiversity and Geological Conservation – Statutory obligations and their Impact within the Planning System*' produced by the Office of the Deputy Prime Minister (ODPM). It has also taken account of a range of other guidance material including that produced by The Planning Inspectorate (PINS) (2017), the European Commission (EC) (2018) and UK Government Ministry of Housing, Communities & Local Government Appropriate Assessment guidance (UK Gov, 2019).

3.13.4 Overview of the Habitats Regulations Assessment Process

The HRA process comprises 4 main stages, which are:

- **Stage 1 Screening** to identify the likely impacts of a project on a European site and consider whether the impacts are likely to be significant;
- **Stage 2 AA** to determine whether the integrity of the European site will be adversely affected by the project;
- **Stage 3 Assessment of Alternative Solutions** to establish if there are any that will result in a lesser effect on the European site; and
- **Stage 4 Imperative Reasons of Overriding Public Interest (IROPI) and Compensatory Measures** to establish whether it is necessary for the project to proceed despite the effects on the European site, and to confirm that necessary compensatory measures are in place to maintain the coherence of the Natura 2000 network.

All 4 stages of the process are referred to collectively as the HRA, to clearly distinguish the whole process from the step within it referred to as the 'Appropriate Assessment' (i.e. Stage 2 AA). The stages are discussed in more detail in Appendix A.

3.14 Marine and Coastal Access Act (2009) / Marine Conservation Zones

Under the Marine and Coastal Access Act (MCAA) (2009) a series of Marine Conservation Zones (MCZs) have been designated around the UK. It is considered good practice to make consideration of MCZs in line with any assessment of European sites.

MCZs have been designated in 3 tranches; the first in 2013, the second in 2016 and, recently, the third in 2019 (JNCC, 2019a). There are currently 91 MCZs designated. MCZs aim to conserve areas of our seas, protecting rare, threatened and representative habitats and species in English inshore and English, Welsh and Northern Irish offshore waters (JNCC, 2019b). The MCZ process specifically takes into account the socio-economic data, alongside the ecological data, during the designation process; also taking into account the views and interests of sea users and interest groups.

[9]The 2017 Habitats Regulations 63(2)

3.15 References

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4 Project Description

4.1 Overview of Technology

Fixed bottom offshore wind technology can face significant challenges in deep waters and is considered to be infeasible in depth greater than 60 m, as a result of installation, operation and maintenance (O&M) and costs associated with foundations. This, therefore, restricts fixed bottom offshore wind to waters close to the coast. However, FLOW has the potential to circumvent these challenges and unlock deeper offshore sites. The technology is still to be tested at large scale, but the potential contribution FLOW can play in the energy mix is being recognised by UK government through the announcement by the Prime Minister in October 2020, with a target set of up to 1 GW of FLOW to be installed by 2030.

FLOW demonstration projects have already been deployed in UK waters. Kincardine and Hywind, both located off the Scottish North Sea coast, have already achieved first power. Once fully operational in 2020, Kincardine, at 50 MW, will be the world's largest FLOW development (Pilot Renewables, 2019). Currently, HyWind (30 MW) is the world's largest FLOW project.

There are no operational FLOW developments in the Celtic Sea. BGW are currently preparing preliminary designs and a consent application for a 96MW test & demonstration development (known as Project Erebus).

Project Valorous, as an early-commercial scale development, will utilise similar technology, enabling lessons learnt to be incorporated into proposed project including those unique to the Celtic Sea region.

The proposal for Project Valorous is for a 300 MW FLOW that will primarily comprise:

- Wind Turbine Generators (WTGs);
- Floating offshore wind platforms and associated moorings;
- Offshore substation;
- Offshore inter-array cables;
- Export cables (marine and onshore);
- Onshore substation; and
- Other associated infrastructure, such as navigational markers.

It is anticipated that the Project will be operational for a period of 25 years, with additional years at each end of operation to construct and decommission the Project.

This chapter provides a description of the different project elements.

4.2 Wind Turbine Generators

The WTGs proposed for the proposed Project are between 9.5 and 16 MW each. The WTGs will likely be mounted on a semi-submersible platform (see Section 4.3).

The main characteristics and specifications of WTGs between 9.5 and 16 MW are shown in Table 4.1. These parameters are indicative and will depend on the preferred turbine that is ultimately selected. For example, the rotor diameter of a 16 MW WTG will be greater than that of a 9.5 MW WTG.

Table 4.1- Proposed project wind turbine generator parameters

Parameter	Value
Number of WTGs	Between 18 and 31
WTG Nameplate Rating	Between 9.5 MW and 16 MW
Swept Area (per turbine)	Up to 45,300 m^2
Max. Blade Tip Height (from sea level)	Up to 270 m
Tower type	Tubular Steel
Hub Height (from sea level)	Up to 150 m
Rotor Diameter	Up to 240 m

Offshore wind turbine technology is developing rapidly. This means the anticipated technology during the project inception and consenting process may be outdated / not available to purchase / install when it comes to project commissioning and construction. It should be noted that, whilst this Scoping Report aims to put forward future-proof project parameters and a reasonable project description, a flexible approach will need to be considered to enable the most appropriate and efficient technology at the time of construction. Therefore, a clearly defined PDE and assessment of the worst case scenario, for example for collision risk modelling (CRM), will be presented in the ES, as detailed in Section 3.4.

4.3 Floating Offshore Wind Platform

The type of platform used will be dependent on contracted design, but at this stage it is anticipated that the individual WTGs will be mounted on a semi-submersible platform with water-entrapment plates and an asymmetric mooring system. The semi-submersible platform will be designed to achieve high stability levels. The platform will provide buoyancy to support the WTG and counteract the large wind-induced overturning momentum.

The platform columns are inter-connected with a truss structure composed of main beams, connecting columns and bracings. Secondary structures include a boat landing on one of the columns, deck space and railings (for personnel access) and associated equipment (onboard davit crane, array cable hang-off etc.). Indicative dimensions and image of an example semi-submersible platform are provided in Table 4.2 and Figure 4.1 respectively. These indicative parameters are subject to change and will be finalised once the preferred WTG has been selected. The ES will include a clearly defined PDE and assessment of the worst case scenario for the semi-submersible platform as detailed in Section 3.4.

Figure 4.1 – Example Semi-Submersible Platform, WindFloat™ Atlantic Project installed in northern Portugal. (Source: Photo courtesy of Principle Power, Artist: DOCK90)

Table 4.2- Indicative Semi-Submersible Platform Parameters

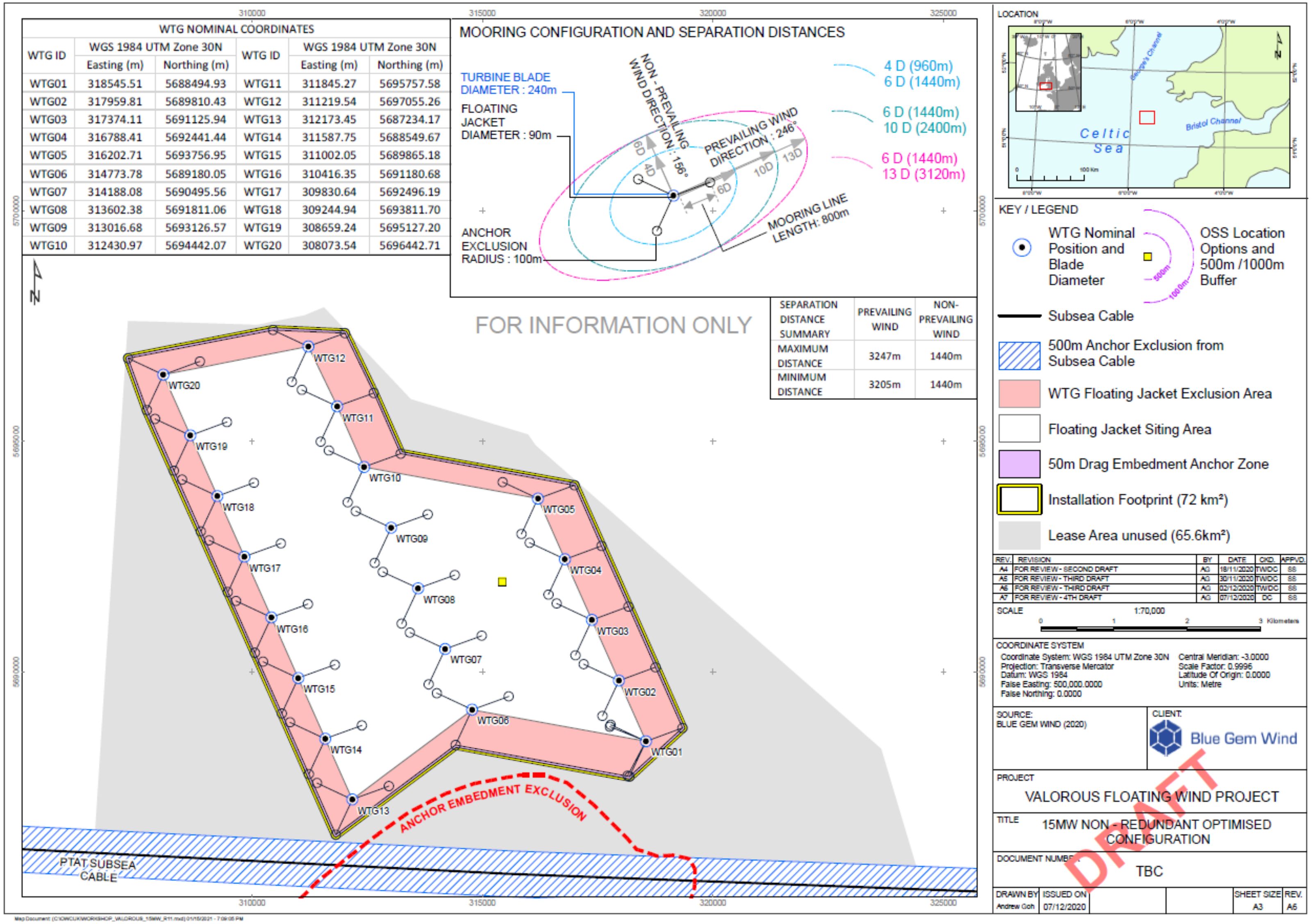
Parameter	Approximate Value and Range
Number of columns	3
Column diameter	9 -21.5 m
Column centre to centre distance	55 – 89 m
Column height	22 - 29 m
Operating Draft (distance from keel to sea level)	11 - 16 m
Maximum footprint (per platform)	10,700 m²

4.4 Array Layout Description

The Project will comprise up to 31 WTG, depending on the WTG capacity. For example, should a 16 MW capacity turbine be used, there will only be 18 WTG, whereas for 9.5 MW capacity turbines, 31 WTG would be required for a maximum output of up to 300MW.

An indicative layout for the semi-submersible platforms, WTG and offshore substation within the Valorous option area is show in Figure 4.2. The layout is subject to change depending on many factors, such as the size of the WTG selected and position of the offshore substation. The array layout will consider the requirements of MGN 543 (MCA, 2016) and it is anticipated that there will be safety zone requirements associated with the offshore substation which will be discussed with the Maritime and Coastguard Agency (MCA). The offshore array area site layout will be determined prior to the EIA / consent applications.

Figure 4.2 - Indicative Site Array Layout (Source: OWC)



WTG ID	WGS 1984 UTM Zone 30N Easting (m)	WGS 1984 UTM Zone 30N Northing (m)	WTG ID	WGS 1984 UTM Zone 30N Easting (m)	WGS 1984 UTM Zone 30N Northing (m)
WTG01	318545.51	5688494.93	WTG11	311845.27	5695757.58
WTG02	317959.81	5689810.43	WTG12	311219.54	5697055.26
WTG03	317374.11	5691125.94	WTG13	312173.45	5687234.17
WTG04	316788.41	5692441.44	WTG14	311587.75	5688549.67
WTG05	316202.71	5693756.95	WTG15	311002.05	5689865.18
WTG06	314773.78	5689180.05	WTG16	310416.35	5691180.68
WTG07	314188.08	5690495.56	WTG17	309830.64	5692496.19
WTG08	313602.38	5691811.06	WTG18	309244.94	5693811.70
WTG09	313016.68	5693126.57	WTG19	308659.24	5695127.20
WTG10	312430.97	5694442.07	WTG20	308073.54	5696442.71

SEPARATION DISTANCE SUMMARY	PREVAILING WIND	NON-PREVAILING WIND
MAXIMUM DISTANCE	3247m	1440m
MINIMUM DISTANCE	3205m	1440m

4.5 Mooring Options

Desk studies and review of readily available datasets indicate that the seabed substrate across the majority of the offshore array area is comprised of sand, with muddy sand in a small area towards the north of the offshore array area. The sand layer lies over a Quaternary deposit formed of soft mud, firm to hard mud and undifferentiated sediments ranging from less than 5 m to 50 m thickness across the site. This will be verified following geotechnical / geophysical surveys which will be performed in parallel to the EIA process. The final mooring solution will be decided following additional design studies which will also be informed by these geophysical and geotechnical studies.

Currently, the following mooring options are being considered:

4.5.1 Drag Embedment Anchors

3 to 5 mooring lines are arranged in a triangular fashion to provide a mooring system with low pre-tension requirements (see Figure 4.3). Each semi-submersible platform is likely to have 3 to 5 anchors, subject to further design studies. The mooring system is designed to address station-keeping issues (it does not need to contribute to the platform's stability) and enables simple connection-disconnection procedures that can be performed by widely available anchor handling vessels.

The proposed catenary mooring system mirrors the system widely used in the offshore oil and gas (O&G) industry and consists of drag-embedment anchors, ground chain, synthetic ropes, as well as various connectors. Concrete or iron clump weights may be used to reduce the size of the mooring lines.

Subject to verification, the drag embedment anchors with chain and iron clump weights and rope option is the most likely (and preferred) solution (see Figure 4.5).

The detailed arrangement of the mooring system is determined by extreme sea-states, water depth, survey results and structural system dynamic modelling and optimisation. Based on the preliminary assessment for the proposed Project, the drag-embedment anchors are likely to be up to 30 tonnes per anchor and the estimated length of each mooring line is up to 900 m..

Figure 4.3 - Example drag-embedment anchor

4.5.2 Suction Piling / Drilled Piles

Though unlikely, site specific seabed conditions may require the employment of other mooring solutions such as suction piles or drilled piles. It is considered unlikely that a suction or drilled pile solution will be required, but as this cannot be excluded at this stage, reference to these potential mooring solutions are included within this EIA Scoping Report.

Potential impacts of all these proposed mooring solutions are presented in Sections 5 to 7.

4.6 Offshore Substation

An offshore substation will be required for energy transmission to shore from the offshore array area site. The offshore substation will consist of two key structures; a topside and a substructure. An example of a typical offshore substation is shown in Figure 4.4. It should be noted that offshore substation topsides are often bespoke structures and therefore do not have standard dimensions. However, indicative dimensions for the offshore substation, based on preliminary design work, are outlined in Table 4.3.

The likely topside will consist of a steel frame structure connected to the top of the foundation (the substructure). The topside will house electrical equipment and supporting functions, such as storage and communication facilities. The topside may be constructed as a single or multiple deck layout, this will be determined through further design work.

Table 4.3 - Indicative offshore substation parameters (Source: Empire, 2020)

Parameter	Approximate Value
Offshore Substation Height	40 m above Mean Sea Level (MSL)
Topside Structure Dimensions	30 m width by 50 m length
Topside Structure Elevation above Sea Level	22 m above MSL

A communications mast and a crane may be included on the topside structure, which could be up to 30 m above the top of the offshore substation. The need and design will be determined through further design work and will be outlined in the EIA and consent applications.

The substructure (foundation) with either be fixed or floating. These will have different installation methods which are outlined in Table 4.4.The fixed substructure will be a jacket foundation which will be fixed using piles or drilled and grouted to the seabed, depending on ground conditions. Floating foundations, such as a semi-submersible or spar, may be feasible and are well suited to the deep-water environment of the offshore array area. However, a floating offshore substation would bring technical risks for the project so is not currently expected to be taken forward.

Figure 4.4. Example offshore substation platform with jack foundation (Source: Empire, 2020)

Table 4.4 - Potential options for project offshore substation

Type	Installation Method
Fixed Offshore Substation	Dependent on ground conditions. Drilling and grouting – most likely option. Maximum of 4 locations to be drilled to approximately 20 m depth. Estimated drilling duration of 40 hours per location (to be confirmed during EIA process). Or Piling – maximum of 4 piles, approximately 2.4 m diameter and 40 m length. Indicative piling duration, between 10 and 15 hours per pile based on preliminary concept design work. (to be confirmed during EIA process)
Floating Offshore Substation	Moored and secured to seabed by drag embedment anchors. Potential for suction piling / drilled piling dependent on site specific ground conditions (as described in section 4.5). Installation expected to be similar to semi-submersible platforms outlined in section 4.4. Mooring requirements dependent on future design studies, anticipated to be up to 8 mooring lines.

4.7 Navigational Markers

Aids to navigation, such as buoys, may be utilised during the construction phase to mitigate potential risks to other sea users. During the operational phase of the proposed Project, the offshore array area may be marked with appropriate navigational marker buoys to provide the necessary warning to mariners of the presence of the site, including identification panels for individual WTGs. The exact type and configuration of any navigational markers will be determined via consultation with the MCA and Trinity House Lighthouse Service (THLS) and will also be informed by the outputs of the project-specific Navigational Risk Assessment (NRA). Navigational aids may be marked with appropriate navigation lights and signage in accordance with relevant MCA guidance, such as guidance note MGN543, and IALA Recommendation O-139 on The Marking of Man-Made Offshore Structures (Edition 2, December 2013). Consideration will be given to use of virtual aids to navigation as well as buoyage. The site will be marked on the UK hydrographic charts and through Kingfisher Information Service - Offshore Renewable & Cable Awareness (KIS-ORCA) to manage fisheries awareness.

The array layout will be determined via consultation with the MCA to ensure Search and Rescue (SAR), and any other requirements of relevant guidance (such as MGN543), are incorporated as required.

Typical examples of aids to navigation to be considered for the proposed Project are shown in Figure 4.5.

Consideration may also be given to the provision of fog signals where appropriate, taking into account the prevailing visibility, topography and vessel traffic conditions. The range of such a fog signal should not be less than 2 nm.

The actual WTGs will also be marked in accordance with relevant aviation requirements and via consultation with key organisations such as the MCA and Civil Aviation Authority (CAA)). CAA Policy and Guidelines on Wind Turbines CAP 764 (CAA, 2016) will be referenced.

Figure 4.5 - Typical Marine Aids to Navigation

(a) Special mark

(b) Cardinal buoy

4.8 Offshore Inter-Array Cables

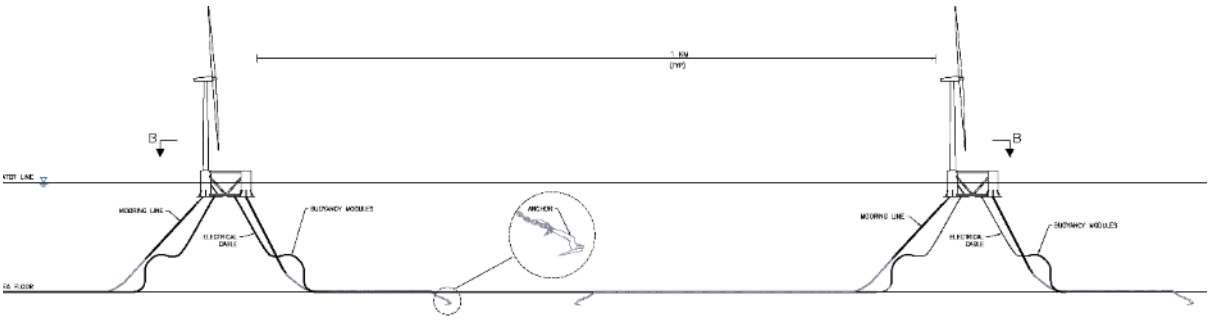
An indicative inter-array electrical cable configuration between the semi-submersible platform units is shown in Figure 4.6. The inter-array cables between the units are anticipated to have a lazy-wave configuration, laying on the seabed between units. The proposed cables will be a 3-core, dynamic design, High Voltage Alternating Current (HVAC) subsea cable rated at 66 kV. The diameter of the inter-array cables is approximately 192 mm. Up to 8 turbines will be connected by inter-array cables to form a string which will, in turn, be connected by a cable section to the offshore platform. The cable section connecting the string to the offshore platform may need to be longer than the typical length of the inter-array cables. There will be up to 6 strings of turbines connected to the offshore platform. The number of dynamic offshore inter-array cables and strings of turbines will depend on the design taken forward, whether this is straight, radial, or looped (ITPE, 2020a). This will be finalised prior to the EIA / consent applications. Inter-array cables are likely to be a combination of buried and surface laid meaning there may be a requirement for scour and cable protection.

Details of the options and parameters for the offshore inter-array cables are outlined in Table 4.5.

Table 4.5 - Potential options and parameters for inter-array cables

Parameter	Approximate Value and Range
Number of Inter-Array Cables	20 – 37
Typical length of individual Inter-Array Cables	1.8 km – 2.2 km
Total length of all Inter-Array Cables	33 km – 83.5 km (dependent on arrangement)
Diameter of individual Inter-Array Cables	146 mm – 192 mm

Figure 4.6 - Inter-Array Electrical Cables Configuration (source: PPI, 2019)



The inter-array cable system will also include the cable hang-off, bend stiffener, buoyancy modules and touchdown point protection.

4.9 Marine Export Cables

Due to the scale and generating capacity of the proposed Project, up to 2 export cables will be required. Each will be a 3-core HVAC subsea cable (rated at 220 kV or 275 kV) and each export cable diameter will be approximately 260 mm.

The proposed export cables are expected to be between 57 km and 62 km long, depending on the final cable(s) route. Due to limits on the permissible spooling length, the cables will likely have between 2 and 4 joints along their length. Short-listed potential export cable corridors and landfall options are shown in Figure 1.2 - Indicative onshore infrastructure options. Details of the options and parameters for the export cables are outline in Table 4.6.

Table 4.6 - Potential options and parameters for export cables

Parameter	Approximate Value and Range
Number of Export Cables	Up to 2
Length of Individual Export Cables	57 – 62 km
Diameter of individual Export Cable	260 mm
Number of Export Cable Joints	2 – 4 (accounting for potential electrical or manufacturing issues)

4.10 Scour and Cable Protection

There may be a need for scour protection around elements of the mooring components, i.e. drag embedment anchors, piles etc.; and also, potentially, cable protection / stabilisation systems along any sections of the export cable route where the required cable depth of cover is unachievable.

The exact amount of scour protection and/or type of cable protection system and associated locations along the export cable route are currently unknown. As future geophysical, geotechnical, environmental, and engineering / design studies are undertaken, a better understanding of the need for such measures will be developed. A maximum amount of scour / cable protection will be assessed via the EIA process and presented in the final ES.

4.11 Cable Landfall and Transition Pit

The potential export cable(s) landfall sites (see Figure 1.2) include:

- West Angle Beach;
- Angle Bay (Sawdern Point);
- Freshwater West Beach; and
- Angle Peninsula South Coast between Whitedole Bay and Gravel Bay.

Installation is proposed via trenching or Horizontal Directional Drilling (HDD). Further details on proposed installation methodologies at landfall are provided in Section 4.14.5 (below).

4.12 Onshore Cables

The onshore export cable is expected to be between 5.5 km and 15 km long, depending on the final landfall location and cable route engineering work (see Figure 1.2) The onshore export cable will comprise 3 to 6 single core buried HVAC cables (rated at 220kV or 275 kV). For the cable route (<2 km) from the Valorous substation to the National Grid Pembroke 400 kV Substation, the cable will be rated at 400 kV. The 3 to 6 cables will be bundled together, either flat or in trefoil (ITPE, 2020b). Where ducts are utilised, each cable will have its own duct with approximate diameter 160 mm to 210 mm. These ducts will then either be laid flat or in trefoil. Details of the options and parameters for the export cables are outlined in Table 4.7

Table 4.7 - Indicative onshore cable parameters

Parameter	Approximate Value and Range
Number of Onshore Export Cables	3 or 6
Length of Individual Onshore Export Cables	5.5 km – 15 km
Diameter of individual Onshore Export Cables	80 mm – 120 mm
Maximum Trench Width	2500 mm
Typical Trench Depth	1000 mm – 1400 mm
Typical Depth of Cover	900 mm – 1200 mm

Depending on the permissible spooling length, the onshore cables will likely have concrete, buried joint chambers (measuring approximately 5 m x 3 m x 2 m) every 500 m to 2000 m along the route. Link box chambers (buried steel inspection chambers) will be required every 2000 m, alongside a joint chamber.

It is proposed that the onshore cable be buried along public highway routes (in-road or verge) and through agricultural land (on headlands or adjacent hedgerows where possible). HDD will be used for infrastructure, ditch, water and major road crossings.

4.13 Grid Connection and Project Substation

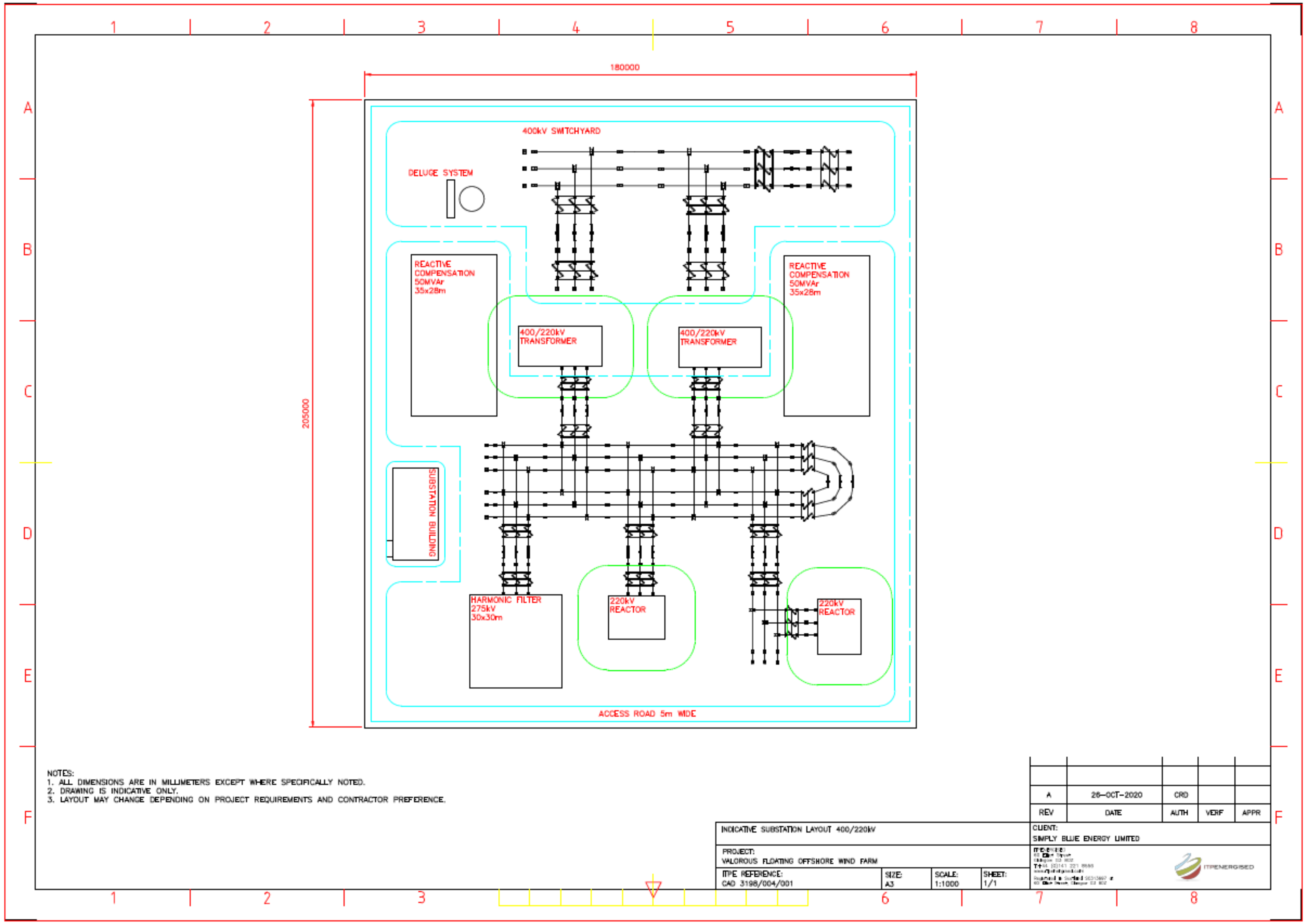
The proposed substation will connect the offshore generation to the onshore network and the GB National Grid. It will house the main transformer(s), HV switchgear, protection and control interface, and power quality management equipment. For regulatory reasons (Connection and Use of System Code (CUSC), NGESO), it is important that this substation is located within 2 km of the point of grid connection. The closer the substation is to the point of connection, the lower the demands are in terms of reactive compensation and, therefore, is preferred electrically.

The indicative dimensions of the proposed substation are approximately 210 m x 180 m with an expected maximum infrastructure height of 15m, see Figure 4.7. The substation compound will comprise as a minimum of:

- (220 or 275) kV Point-on-Wave (POW) Switchgear;
- Harmonic Filters;
- Reactive Compensation;
- 400/ (220 or 275) kV Transformer;
- 400 kV Switchgear;
- Control and protection building;
- Welfare building;
- Compound lighting;
- Perimeter security; and
- Access road.

The Project has a grid connection agreement in place with NGESO. This agreement subsequently outlines the point of connection agreed for the Project at the NGET owned Pembroke 400 kV Substation, adjacent to the Pembroke Power Station. The agreed Transmission Entry Capacity (TEC) has been set at 300 MW and the project will have to abide by the Offshore Transmission Operator (OFTO) standards.

Figure 4.7- Indicative onshore substation layout



4.14 Proposed Construction Methodology

4.14.1 Wind Turbine Generator and Floating Platforms

4.14.1.1 *Port - Wind Turbine Generator and Floating Platforms*

It is proposed that the WTGs will be installed and commissioned on the semi-submersible platform at a port facility and/or nearby sheltered waters, in the Celtic Sea region where possible. It is also anticipated that the final stages of the semi-submersible platform assembly, prior to WTG integration, are also undertaken at the same local port(s), if facilities are determined sufficient to support this work.

The exact details of WTG integration at port and / or in sheltered waters will be determined throughout the project planning. The following activities are anticipated to be undertaken when integrating the WTG to the semi-submersible platform and transfer to the offshore array area, see also Figure 4.8:

1. Mobilisation and erection of high-capacity land-based crane;
2. Unloading in-bound WTG components from supply vessel;
3. Laying down of WTG components;
4. Unload semi-submersible platforms from supply vessel (or barge), and wet store/moor semi-submersible platform at quayside;
5. Prepare turbine components for assembly (nacelles, rotors and/or towers);
6. Assembly of WTG onto semi-submersible platform moored at quayside;
7. Pre-commissioning of fully assembled semi-submersible platform and WTG unit at quayside; and
8. Towing of semi-submersible platform unit to offshore array area (via tugs at between 2 and 4 knots), see Figure 4.8. The target semi-submersible platform delivery rate is 2 units per week.

Each semi-submersible platform unit would arrive at the turbine installation site pre-ballasted and in an even keel position. A spacer barge or fenders may be used to separate the semi-submersible platform unit from the side of the quay. Mooring and spring lines would keep the unit in a stable position at quayside. While the unit is floating and moored quayside, turbine components will be mounted and secured, one by one, onto the hull. Sequentially, the turbine components will be lifted and secured to the unit. The semi-submersible platform unit should remain even keel during the whole operation by adding or removing ballast water to / from the different compartments, or grounding at the quayside as the weight of each wind turbine component is being transferred from the crane onto the unit.

Figure 4.8 – Example of Assembly of Wind Turbine Generator onto semi-submersible WindFloat™ at quayside and towing out (Source: Photo courtesy of Principle Power. Artist: DOCK90)

4.14.1.2 *Offshore - Wind Turbine Generator and Floating Platforms*

The proposed installation works at the offshore array area would involve the following sequence:

1. Pre-installation survey;
2. Offshore substation installation, hook up and commissioning;
3. Export cables installation, stabilisation and testing;
4. Mooring System Pre-Lay: using Anchor Handling Tug Supply) vessels. Mooring lines will be laid one after another for each unit. After their deployment, the anchors will be proof load tested to a level of tension specified during the engineering phase. Except for the anchor and anchor chain, no other part of the permanent mooring system will be connected during proof-load testing. In order to verify the correct positioning of the anchors after the test, the mooring lines may be equipped with transponders, or similar systems;
5. Offshore Tow and Mooring Hook-Up: the tow would be timed when weather forecasts indicate a suitable weather window for the planned hook-up works as well as the tow. The mooring hook-up requires the use of the onboard winch to pull in the mooring line itself. Thus, an offshore team will be working from the unit to operate the winch; and
6. Inter-Array Dynamic Cable Post-Lay: installation of the inter-array cable will be coordinated with the unit mooring hook-up. The cable will be spooled from a suitable cable handling spread mobilised to an installation vessel. The winch onboard the semi-submersible platform will be used to pull-in the dynamic cable to the point of connection. Once the dynamic cables, hang-offs, bend stiffeners, buoyancy modules

and touchdown point abrasion protection equipment has been installed, the cables will be stabilised with rock bags or mattresses.

4.14.2 Offshore Substation

As set out in Section 4.6, the specifications of the offshore substation have not yet been finalised. The construction methods for the designs under consideration, namely fixed and floating offshore substation, would differ slightly.

For the fixed offshore substation, the jacket foundations would be installed using a heavy lift vessel, likely from a barge and placed into position. The jacket would most likely be fixed to the seabed using driven piles or drilled and grouted piles. All works would likely be performed from the heavy lift vessel. Once the jacket is fixed, the topside would be installed on the jacket foundation and hooked up.

For the floating offshore substation option, the installation method would be similar to the WTG semi-submersible platforms detailed in Section 4.14.1.2, with majority of assembly works occurring at port facilities or nearby sheltered waters, then towed to site.

After the topside has been installed onto the foundation, cables would then be pulled into the topside and terminated. Once the export cable have been installed and is connected to the onshore grid, the offshore substation would be fully commissioned. Hook up and commissioning activities would be conducted from a suitable vessel supporting the main installation works with further support from Crew Transfer Vessels (CTVs).

4.14.3 Inter-Array Cables

The dynamic inter-array cables can be installed in several different configurations depending on whether the WTG platform is being deployed to its final location.

To optimise the array cable manufacturing efficiency, and reducing costs, several array cables of the same design may be manufactured in a single factory length with a dynamic section at each end and a static section in the middle connected by factory joints. The full cable static/dynamic array cable length is usually pre-laid and left on site in so called “wet storage” ready for the “first-end pull in” operations.

After the cable is laid-up and the WTG platform has arrived at the site for its installation, the pull-in operation takes place. The wet-storage approach requires a waterproofed end cap seal at the free end of the cables. Additionally, the cable end should be fitted with an appropriate rigging to enable a safe recovery for later connection to the WTG platform via a messenger wire.

This design and installation configuration is the preferred approach of the major cable manufacturers and is reflected in the design assumptions for the project.

Alternatively, the static and dynamic sections can be manufactured separately, and a permanent mate-able transition joint can be installed to connect them.

Mate-able joints can be either wet-mate or dry-mate type. While wet-mate connectors allow each cable end to be connected and disconnected underwater by an ROV’s manipulator, dry-mate connectors require assembly on board the Cable Lay Vessel. Therefore, the static cable end has to be pulled up, and after being jointed with the dynamic cable end, can be lowered to the seabed ready for the “first-end pull in” operations.

4.14.4 Marine Export Cables

The proposed marine export cable will be installed using cable installation vessels. Cable burial in sediment rich zones can be completed using a number of different methods: submarine ploughing; dredging; mechanical excavation; water jetting excavation; and tracked

ROV. Cable trenching with plough is proposed where possible to minimise seabed disturbance. The plough itself runs on skids with a contact width less than 5m. The trench itself would typically be less than 1m in width and less than or equal to 2.5m in depth.

The proposed marine export cable routes will avoid non-mobile features such as sudden seabed level changes or wrecks. However, prior to deployment, the export cable corridors will need to be cleared from any recorded mobile features such as suspected UXOs and boulders. Specific survey extents will form the basis of such clearance operations to ensure that all risks within the surrounding environment are minimised to an acceptable level. Once the corridor is prepared, different cable installation and protection techniques will enable reliable and safe operation within the marine environment for the proposed project lifetime.

Where cable burial is not possible due to hard substrates, it is proposed the cables will be surface laid and then stabilised using various solutions such as concrete mattresses, rock bags or rock dumping (see Section 4.10). These artificial cable protection solutions would require a vessel with a crane in order to lift the cable stabilising product and to lower it onto the cables at the required locations, determined during the engineering cable stability assessment. The locations are determined to both stabilise and protect the cables.

4.14.5 Landfall

Cable installation methods will be refined throughout the proposed project planning and design. It is anticipated that the cable installation may be trench and/or Horizontal Directional Drilling (HDD):

1. Trenching: The beach landing usually consists of a trench in which the cable is laid and then buried. This avoids any unwanted cable displacement, keeping it out of the surf zone, hence reducing risk of damage. The operation is carried out with a cable plough which buries the cable into a trench as it travels. When the export cable(s) are successfully landed, they can then be safely laid to the offshore array area and offshore substation.
2. HDD: Sometimes the beach landing described above is not suitable, this could be for one of a number of reasons - example constraints are: if the minimum burial depth requirements cannot be fulfilled; if the beach is too narrow; if there is a high cliff. A solution to these problems is the use of HDD. The HDD bore will be approximately 1600 mm in diameter and will be drilled from the acceptable point of cable emergence onshore to the point of safe cable exposure offshore. This is generally away from the cliff and deep enough not to be exposed due to erosion or contribute to the natural erosion rates. This operation requires a special drilling tool capable of drilling horizontally and with the flexibility to change height as it drills to gradually curve from the entry point to the eventual exit height.

4.14.6 Onshore Works - Cables and Onshore Substation

In general, it is proposed that the cables will be installed at a minimum depth of 910mm to the top of the cable or duct. This may increase to 1500mm or more where necessary (such as in arable land). These depths are in accordance with National Joint Utilities Group (NJUG) guidance. Ideally, the cable will be direct buried where there is sufficient time to open a trench, install the cable, and cover the trench again. In most cases in roads and tracks this method is not possible due to the requirements to have a trench of up to 2500m to be open before the 500m cable on the drum is installed. In this case, it would be proposed that ducts are installed in 20-50m sections and closed over; cables are then pulled in every 500m or so and jointed. Installing short sections of duct on road crossing and access points is mandatory. Where possible, the number of sizes of cable will be limited to 2 or 3 as a maximum. Larger cable sizes will be used in the deeper sections, small sizes in the shallow direct buried sections.

The cable installation is likely to be sequential along the cable route starting from either landfall or the substation. The onshore works will begin by erecting temporary fencing to prevent entry from members of the public and livestock from straying onto a working area. Temporary lighting may be required within the construction compound. Where required any vegetation will be removed along with the levelling of land, likely limited to the substation site and construction compounds, and topsoil and subsoil may be stored at the edge of the construction compound. Trenching and duct installation will be undertaken followed by back fill and reinstatement of topsoil where required. Following the completion of the works temporary installations will be removed.

The onshore substation will be subject to a detailed design and engineering process which will include the proposed approach to construction. This will occur once the final location of the onshore substation has been agreed.

In general, the substation works will commence as per the cable installation with the erection of fencing, lighting and land clearing. The entire substation footprint will be stone-capped to provide stability for construction operations. While the land is initially being processed, a temporary construction compound will be established. The temporary foundation for the compound will be built by removing the top ground layer and covering it with crushed stones. Cable ducts or entrances will be installed followed by the erection of the palisade security fence and foundation work for any buildings or electrical plant platforms. Electrical plant will be transported to site and installed. This may require abnormal loads which are further discussed in Section 7.7.Once the proposed substation is built and the equipment checked, safety rules will be developed prior to connecting the proposed Project substation to the grid connection point at 400kV. At this point the substation can be commissioned and connected to the 400kV network

4.15 Operation and Maintenance Phase

Planned maintenance inspections of the proposed Project are expected to be performed daily via CTVs. The O&M activities and CTV are expected to be operated out of a UK based port which houses an O&M base office; it is possible that this will be Pembroke Port. O&M will run throughout the year but is expected to have increased activity during the summer when weather windows are suitable for accessing the offshore platforms.

The majority of O&M activities will be performed on the WTG components with ongoing maintenance inspections. In the event of a major repair, the WTG platform will be towed via a tug to a port facility or sheltered waters, where possible locally. Pembroke Port is the closest available location to the proposed Project.

A major return to port asset repair or service event is expected once during the 25-year operational life. Major work will utilise a local port and land-based cranes or use of jackups in support. Return to port, or sheltered waters, will require the disconnection and later reconnection of the semi-submersible platform to the moorings and inter array cables. This done by first disconnecting and over boarding the cable hang-off assembly. This is designed to float on location as a buoy whilst repairs are underway and is held in position by the attached dynamic cables. This assembly also allows the continued operation of the wind farm whilst a single unit is removed from service. Following electrical disconnection, the moorings are disconnected and the semi-submersible platform may then be towed to port. Once repairs are completed and the unit is recommissioned, it may be towed back to site where moorings are re-installed and then the cable hang off assembly re-attached to the Platform and electrical connections restored.

Planned minor offshore maintenance is aligned with the WTG manufacturer maintenance recommendations. Inspections of the moorings and sub-structure are also required periodically. These will, where possible, be undertaken using ROVs to avoid the use of commercial diving activity.

Inspections and minor maintenance would typically be undertaken at the following intervals during the Project's operational life: 6 month, 1.5 year, 2.5 year, 3.5 year, 5 year, 7.5 year, 12.5 year, 17.5 year, 22.5 year, 24.5 year (assessment for decommissioning), 25 year (decommissioning). The programme will, however, vary depending on findings and the need to monitor condition in a responsible and proactive manner.

4.16 Decommissioning

It is proposed that an outline decommissioning plan be prepared and submitted with the consent applications. The exact process of decommissioning will be agreed towards the end of the operational lifetime of 25 years, in accordance with applicable legislation and guidelines at that time. It is expected that decommissioning will comprise the reversal of the installation process, with WTG platforms and moorings removed from the Project area and returned to ports for disassembly and disposal. Cable decommissioning will also be decided toward the end of the project lifetime. The preferred option is for the cable to be left *in situ* as far as is possible from a technical and environmental perspective. Advice will be sought from regulators, SNCBs and stakeholders to determine the most feasible approach to cable decommissioning.

4.17 Indicative Timescales

Table 4.8 - Indicative Development Programme

Activity	Indicative Date
Engineering and EIA Surveys Completed	Q2 2023
FEED Completed	Q2 2024
Primary Consents Applications Submitted	Q3 2023
Primary Consents Determined	Q4 2024
Detailed Design Finalised	Q3 2026
Pre-Construction Consent Compliance	Q1 2025
Additional Consents	Q1 2025
Construction Started (Onshore)	Q4 2026
Construction started (Offshore)	Q3 2028

Activity	Indicative Date
Substation Connection Date	Q2 2029
Construction Complete/Commissioning	Q4 2029
Decommissioning	Q4 2054

4.18 References

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5 Physical Environment

5.1 Marine Coastal Processes (Geology and Geomorphology, Metocean, and Sedimentary Processes)

5.1.1 Study Area

Due to the potential local and regional effects on hydrodynamics and sedimentary process, the Study Area for this section of the Scoping Report comprises a portion of St George's Channel and the northwestern Bristol Channel, running into the southwestern coast of Pembrokeshire. Natural Resources Wales (NRW) advice on a marine aggregates Plan-level Habitats Regulations Assessment (HRA) indicates that a potential tide-parallel Secondary Impact Zone (SIZ) of up to 10 km in each direction should be considered (TCE *et al*, 2019); this advice, along with information on the tidal ellipse at the site will be taken in to account to inform the SIZ during the Environmental Statement (ES).

5.1.2 Baseline Data

A range of baseline data sources has been used to compile this section of the Scoping Report, including:

- ABPmer, 2019. Atlas of UK Marine Renewable Energy – information of wind, waves and tides;
- British Geological Survey (BGS), 2017a; 2017b – geological units, Quaternary deposits and seabed sediments;
- Cefas, 2020. WaveNet – real time data from the SEACAMS PDZ and Dale Roads WaveRider buoy;
- DTI, 2007. Offshore Oil and Gas Strategic Environment Assessment (SEA) 8 Overall Report and associated specialist reports;
- EMODnet – Sea Floor Geology (2020a) and seabed substrate (2020b) information;
- Greenlink Interconnector Ltd, 2019. Greenlink Interconnector Marine Environmental Statement – Wales.
- Intertek Ltd, 2018. Greenlink Interconnector Environmental Scoping Report – UK Marine Route. Rev 2;
- Intertek, 2019. Erebus Stage 1 Floating Windfarm Geological Desk Top Study;
- Mackie et al., 2006. The Outer Bristol Channel Marine Habitat Study;
- RPS Energy, 2018. Marine Energy Test Area (META) Environmental Impact Assessment Scoping Report;
- RWE, 2012. Atlantic Array Offshore Wind Farm Environmental Statement Volume 1: Chapter 6 – Physical Processes;
- UKHO and Admiralty Charts – bathymetry and Tidal Diamond data (undated);
- Wave Hub Ltd, 2018. Pembrokeshire Demonstration Zone Feasibility Study Environmental Scoping Report;
- Wave Venture, 2020. Consolidated Metocean Analysis Desk-Study. Blue Gem Wind – Erebus.

5.1.3 Geological and Geomorphological Baseline

5.1.3.1 Bathymetry

The dominant bathymetric feature of the region is the wide trough, correlating with St George's Channel, to the west of the scoped area, where maximum depths are in excess of 100 m. In general, depth decreases towards the coast and to the east, into the Bristol Channel, and further into the Severn Estuary (Figure 5.1).

A geological desk-top study, specifically undertaken by Intertek (2019) covering the scoped area, summarises bathymetric data from a range of sources, including UKHO bathymetric data available from EMODnet, as well as data available from a series of high-resolution bathymetric surveys. Intertek (2019) reports that water depths over the greater scoped area range from 0-85 m below Lowest Astronomical Tide (LAT), while the water depths in the vicinity of the Project Site range from 72-84 m below LAT.

Figure 5.1 - Bathymetry in the Vicinity of the Scoped Area and Wider Area (Source: EMODnet, 2018)

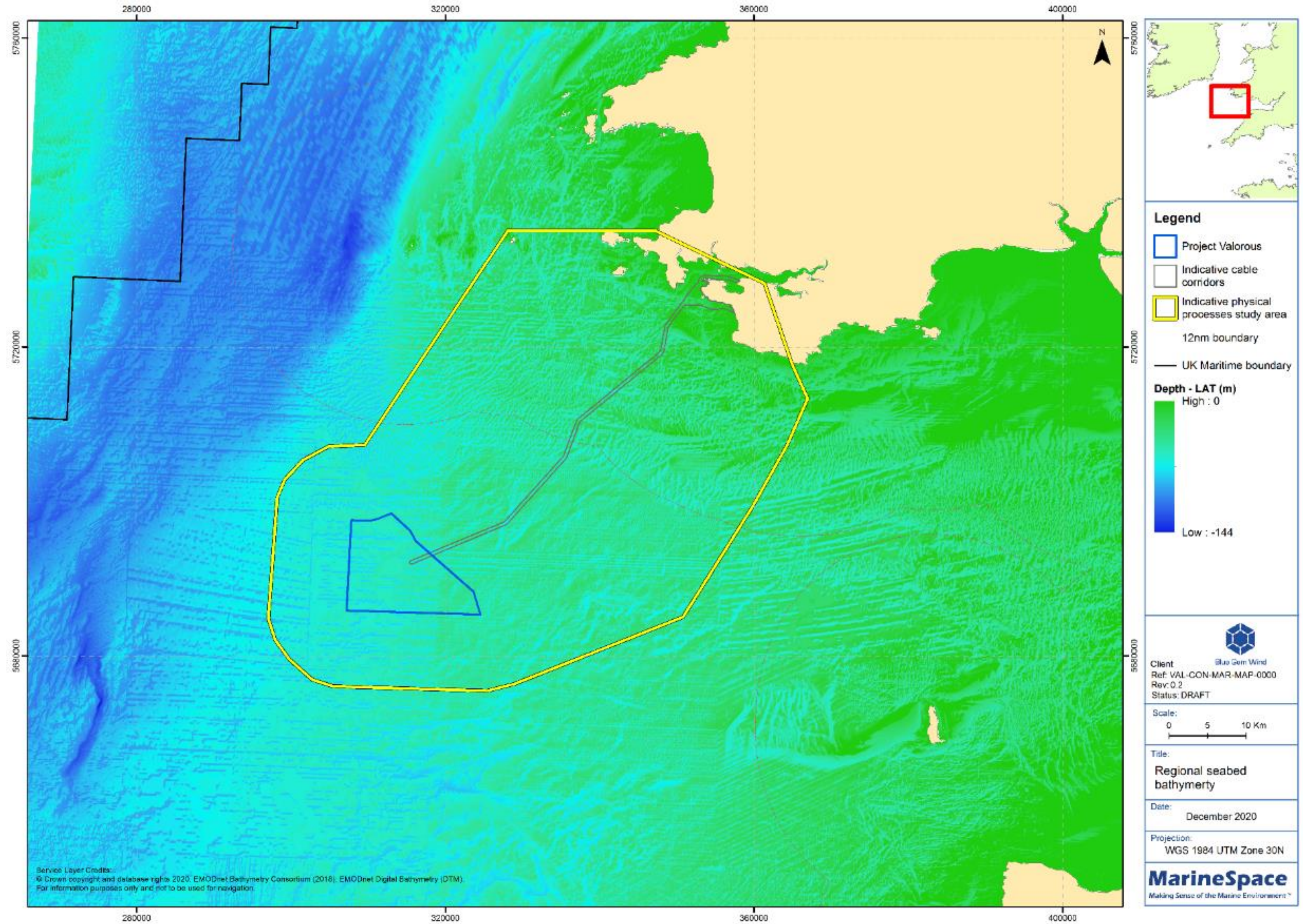
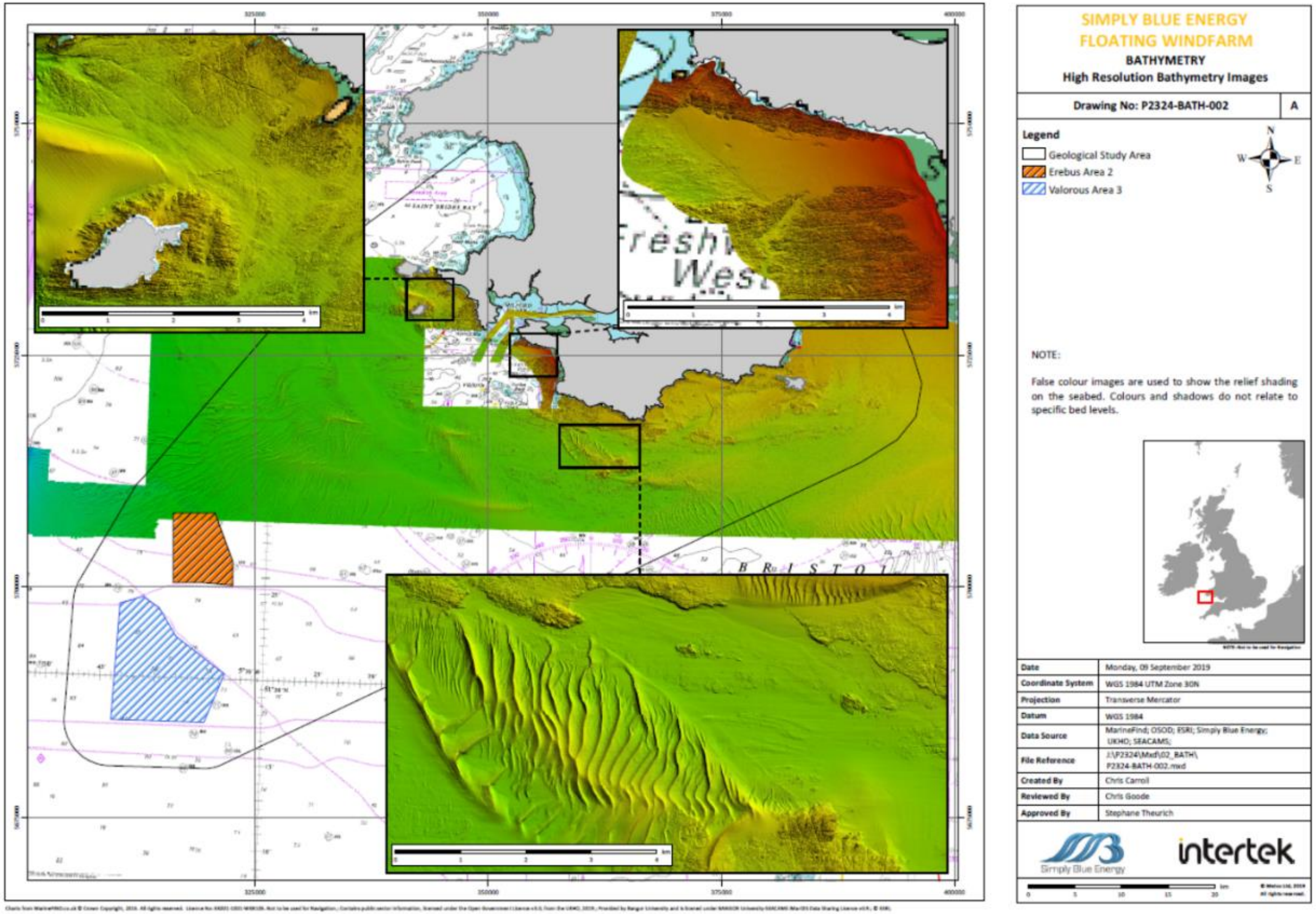


Figure 5.2 - High Resolution Bathymetry in the Vicinity of the Historic Scoped Area (From: Intertek, 2019)



5.1.3.2 Bedrock Geology

Southern Britain, including the area which includes the Outer Bristol Channel into St George's Channel, has been subject to sedimentation and major tectonic episodes over hundreds of millions of years. Regionally, underlying bedrock geology of varying age is reported, comprising Palaeozoic rock (541 – 252.17 million years ago) overlain by Permian (252.17 – 298.9 million years ago), Mesozoic (252.17 – 66 million years ago) and Tertiary strata (66 – 2.58 million years ago). Overlying Quaternary sediments can exceed 300 m in depth (Tappin *et al.*, 2007) in parts of the region.

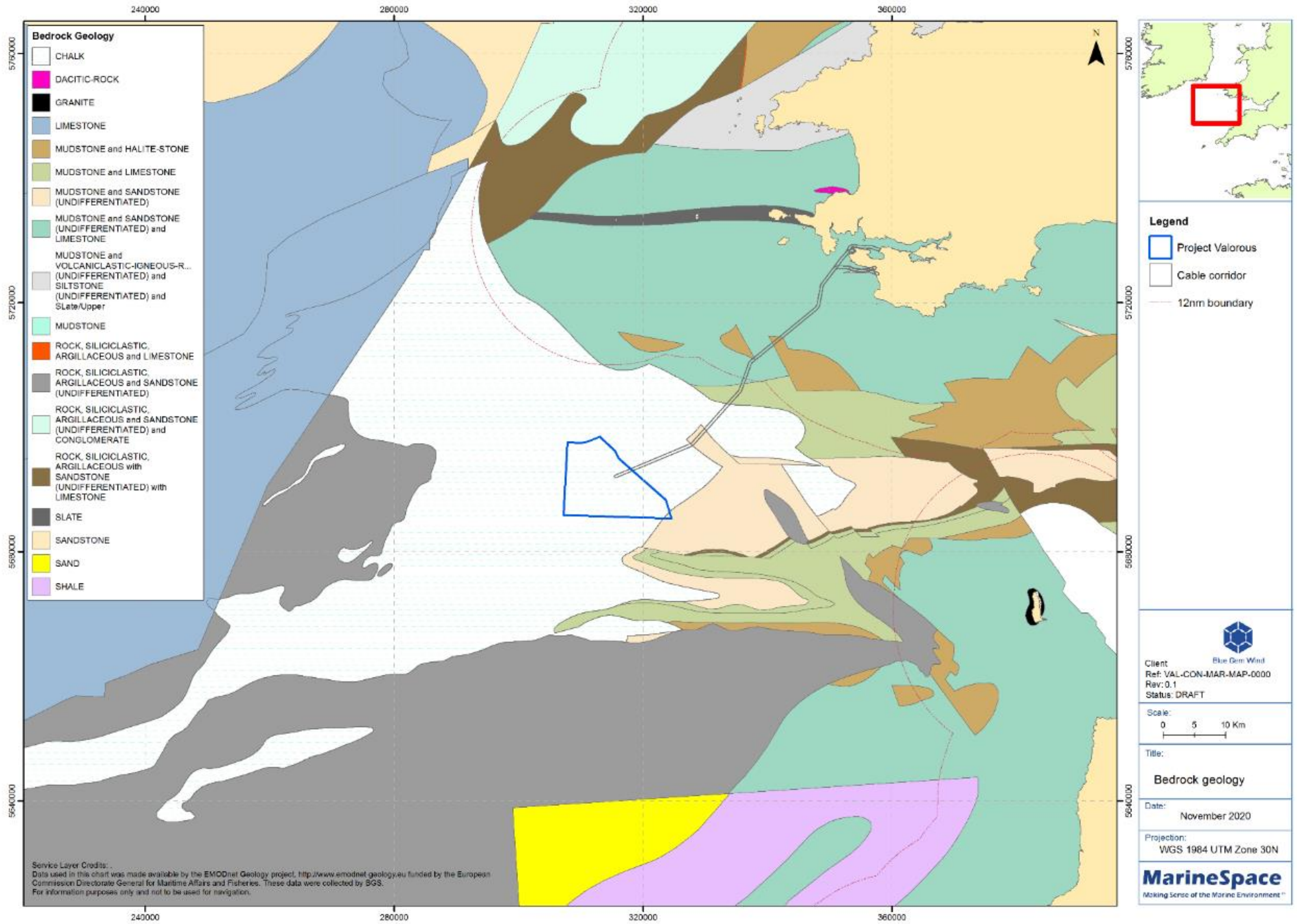
The central Celtic Sea comprises Upper Cretaceous (100.5 – 66 million years ago) and Paleogene sedimentary rock (66 – 23.03 million years ago), with Devonian to Carboniferous rock extending along the coast of southern Ireland (Tappin *et al.*, 2007).

The Bristol Channel is floored by Jurassic and Triassic rocks with Palaeozoic rocks on the coastal margins. Westward, these are overstepped by the Cretaceous Chalk that, in turn, is buried beneath Tertiary strata. The central floor of the Bristol Channel comprises a submarine valley system, extending up into the Severn Estuary, which was incised during the late-Tertiary – early Quaternary (Evans 1982; Mackie *et al*., 2006). Mackie *et al.* (2006) report that the form and morphology of the present-day seabed includes elements directly related to the erosion and deposition associated with the formation of the submarine valley, e.g. rock platforms.

The bedrock geology indicates that the dominant bedrock types identified in the vicinity of the proposed offshore array area, including the potential export cable corridor to shore (Figure 5.3) are:

1. Chalk underlying the main offshore array;
2. Mudstone and sandstone to the southeast of the main offshore array area and crossing some of the potential export cable corridor;
3. Mudstone, sandstone and limestone from landfall along the potential export cable corridor;
4. Mudstone and halite in isolated areas crossing part of the potential export cable corridor;
5. Mudstone and limestone crossing part of the potential export cable corridor.

Figure 5.3 - Bedrock Geology in the Vicinity of the Scoped Area and Wider Area (From: EMODnet, 2020a)



5.1.3.3 Quaternary Geology

Quaternary deposits are those laid down during the Quaternary Period (2.6 Ma to Recent). During the Quaternary, glacial and interglacial events shaped the environment of this part of northern Europe. During glacial periods regional sea levels were lower than the present time (low stands), while during the interglacials sea levels were comparable to their current level (high stands).

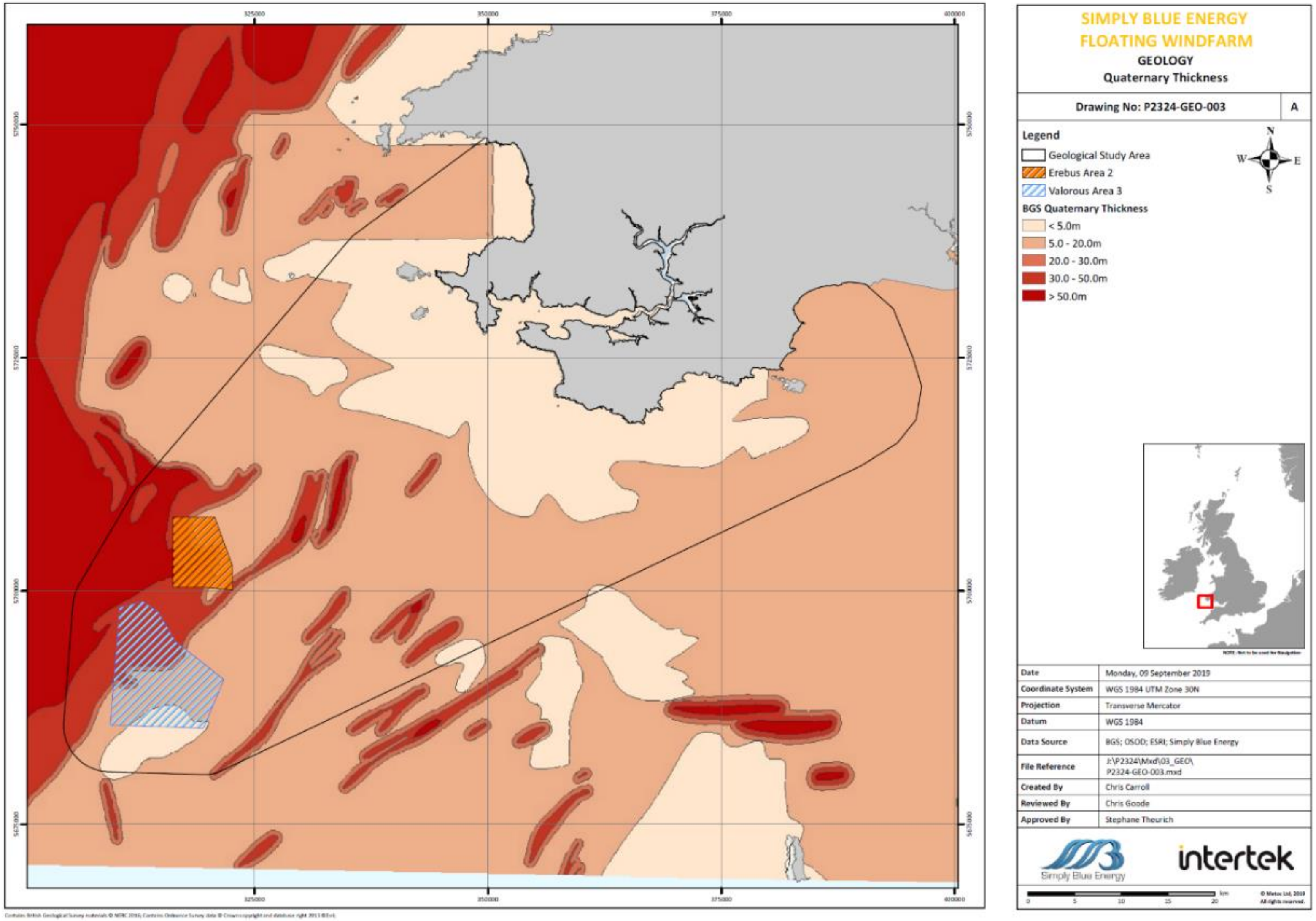
St George's Channel lies in the middle of the Irish and Celtic Sea and was subject to extensive glaciation over the past 25,000 years (Tappin *et al*., 1994). During the Pleistocene the Irish Sea Glacier flowed southwards, on more than one occasion, through St George's Channel and into the northern Celtic Sea, transporting and depositing the Quaternary sediments present today.

Intertek (2019) summarises the Quaternary Formations present in the Irish Sea and St George's Channel as consisting of the following (youngest to oldest):

- Western Irish Sea Formation;
- Cardigan Bay Formation;
- St Georges Channel Formation; and
- Caernarfon Bay Formation.

Intertek (2019) indicates that the Cardigan Bay Formation makes up most of the Quaternary seabed deposits underlying St George's Channel and Cardigan Bay. The Cardigan Bay Formation is a till deposit, consisting of a stiff to hard clay containing varying amounts of sand, gravel, shell, cobbles and bounders. On top of the Cardigan Bay Formation is the Western Irish Sea Formation, comprising localised infill deposits and overlying stratified deposits of 5 different facies, from sands, gravels, tills and silts to cobbles and boulders. The Quaternary Formations are thickest to the west of the proposed Project site, reaching in excess of 50 m thickness; however an area of thin Quaternary deposits may occur in the vicinity of the southern boundary of the Project site. In general, the Quaternary deposits become thinner to the northeast, towards the coast (Figure 5.4).

Figure 5.4 - Thickness of Quaternary Deposits in the Vicinity of the Historic Scoped Area (From: Intertek, 2019)



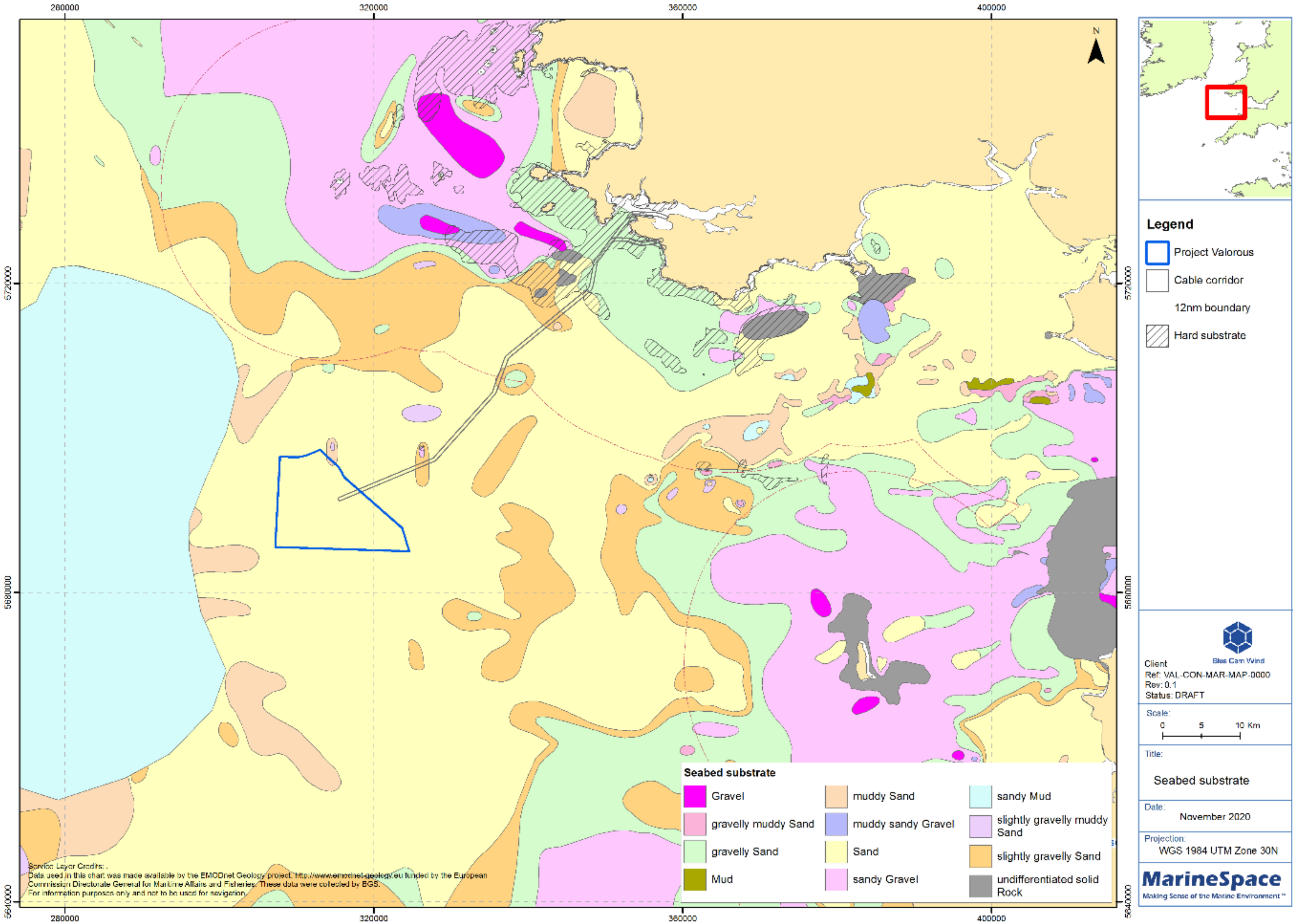
5.1.3.4 Recent Seabed Sediments

Recent seabed sediments are those deposited during the Holocene (approximately the last 15,000 years) and influenced by the rising sea levels since the most recent (Late Devensian) glaciation.

Seabed sediments off the west coast of Wales predominantly consist of sandy gravel with nearshore areas of sand (DECC, 2016). The inshore seabed around the south Pembrokeshire coast is characterised by rocky reef, shoals and sandbanks. BGS seabed sediment data, summarised in Intertek (2019; Figure 5.5), show the seabed in the vicinity of the proposed Project Site to primarily consist of sand, with increased amounts of gravel in sediments closer to the coast. Very fine muds are present in sheltered areas of the Milford Haven waterway. Rocky reef is also present within the nearshore, Figure 5.5 shows this as hard substrate.

Figure 5.2indicates that the unconsolidated sediment across of much of the seabed inshore is likely to be formed into bedform fields, comprising subaqueous dunes, with crests typically oriented from southwest-northeast to north-south. Further east and nearshore, to the south of Carmarthen Bay, there is an extensive sand wave field (Mackie *et al.*, 2006) and areas of subaqueous dunes and larger banks (such as Turbot Bank) are relatively common.

Figure 5.5 - Seabed sediments in the Vicinity of the Scoped Area (Source: EMODnet, 2020b)



5.1.4 Metocean Baseline

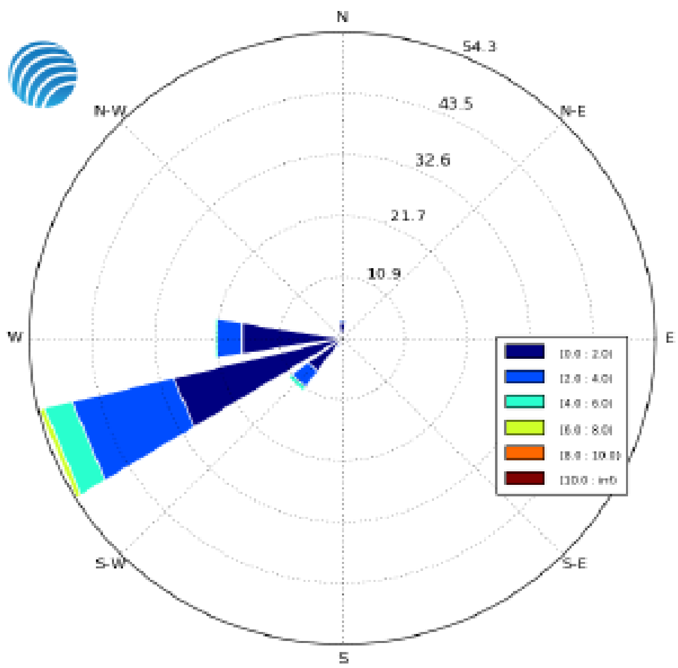
5.1.4.1 *Waves*

The following information is taken from a range of sources including a desk-based review of wider literature sources, as well as a project-specific desk-based metocean assessment for Project Erebus, located approximately 5 km northeast of offshore array area, which was prepared by Wave Venture Ltd on behalf of BGW (Wave Venture, 2020). Further supporting studies for the offshore array area will be available in 2021.

Waves within the Bristol Channel are driven by the wind regime, with the largest waves being driven by winds from the longest fetch direction from the southwest. Exposure to the largest waves is more pronounced on coasts and submarine shoals facing the longest fetch. Uncles and Stephens (2007) report that parts of the coast of this region are among the windiest in the UK and that mean hourly coastal wind speeds exceed approximately 3.5 m/s for 75% of the time, and exceed 19 m/s for approximately 0.1% of the time. The mean long-term wind speed for Erebus was 7.7 m/s (10 m height) and 9.8 m/s (110 m height) (Wave Venture, 2020), and was above 4 m/s more than 82% of the time at 10 m height (>89% at 110 m height). Dominant southwesterly winds were identified to blow for approximately 25% of the time (Wave Venture, 2020). Uncles and Stephens (2007) also indicate that winds blow for 40% of the time from the southwest and west. Uncles and Stephens (2007) conclude that the significant wave height in the outer reaches of the Bristol Channel and St George's Channel is greater than about 3 m for 10% of the year (compared with a predicted 50-year extreme of 18 m).

Outputs of the project-specific metocean study, for nearby Project Erebus, (Wave Venture, 2020) indicate that long term mean significant wave height is 1.91 m and most frequent significant wave height is between 1.0-2.0 m. Dominant wave direction is 252º (southwesterly, which coincides with the main wind direction from southwest.

Figure 5.6 - Wave Rose of Long-Term Wave Directions and Significant Wave Heights (From: Wave Venture, 2020)



These values are supported by data available from the UK Renewable Atlas (ABPmer, 2019), and shown in Table 5.2

Table 5.1 Current Speeds and Directions for Tidal Diamond P, 6 km to the Southwest of the Offshore Array Area

Time relative to High Water (hrs)	Current Direction (º)	Spring current speed (m/s)	Neap current speed (m/s)
-6	040	0.6	0.3
-5	007	0.6	0.3
-4	326	0.6	0.3
-3	304	0.7	0.3
-2	283	0.7	0.3
-1	258	0.6	0.3
0	215	0.6	0.3
1	179	0.7	0.3
2	148	0.6	0.3
3	123	0.6	0.3
4	102	0.6	0.3
5	079	0.5	0.3
6	049	0.5	0.3

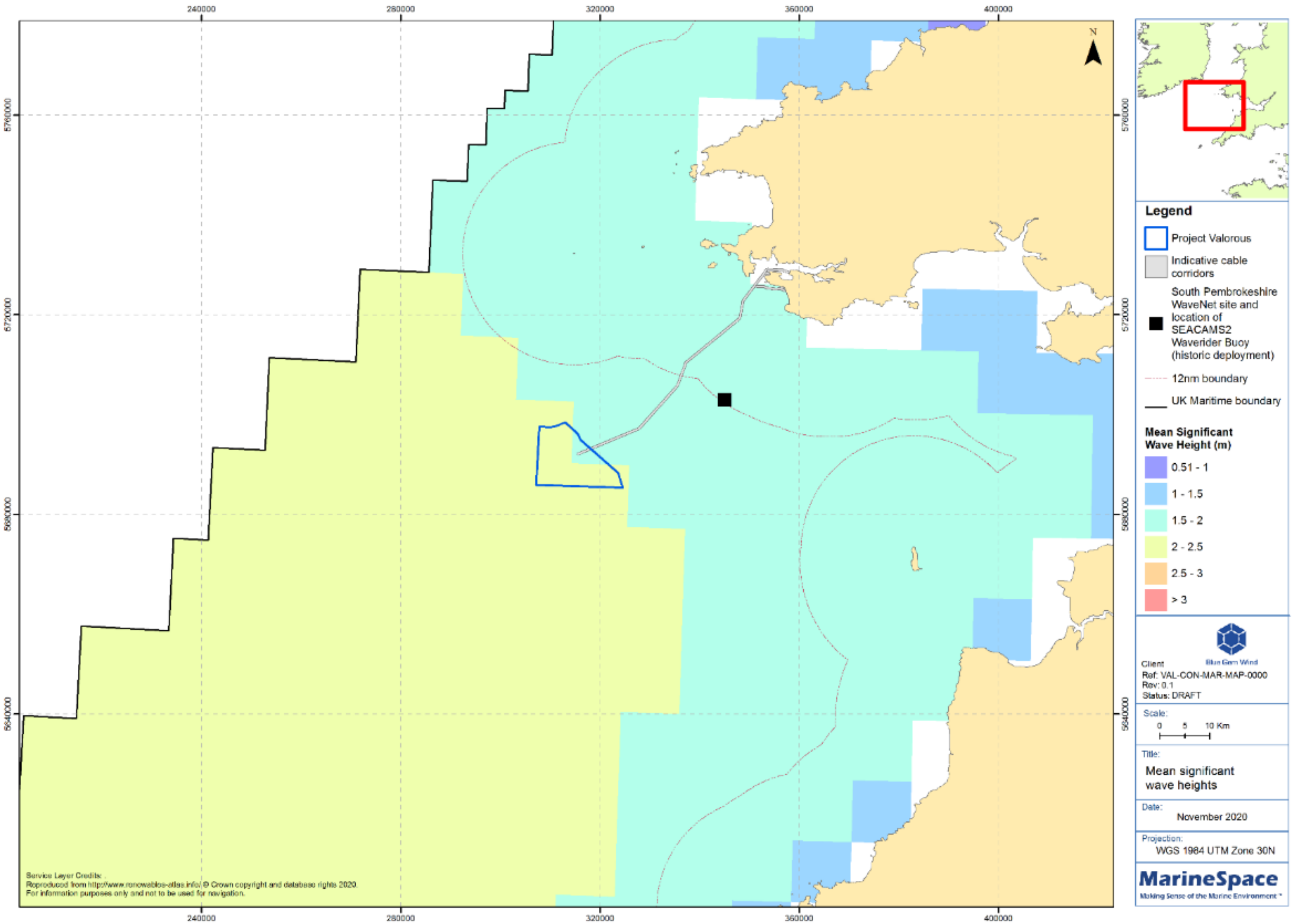
Tidal water levels can be modified by storm surges which occur when deep atmospheric depressions move through the area. Uncles and Stephens (2007) suggest that these may increase water levels by over 1.0 m, as an extreme value, during a 50-year return period.

Changes to sea level may change over the life cycle of the project, and as such by 2050, it is predicted that within the Outer Bristol Channel, the relative sea level may potentially rise by up to 0.32 m above 2012 levels (values taken at Ilfracombe from the United Kingdom Climate Projections 2009 (UKCP09) medium emissions scenario) (RWE, 2012). Figure 5.7, which suggest that the northeast portion of the proposed Project site mainly lie in a zone where significant wave heights are in the range of 1.5-2 m. ABPmer (2019) suggests that significant wave heights towards the southwest of the proposed Project site may reach 2-2.5 m.

The Cefas WaveNet data, for the SEACAMS2 PDZ WaveRider buoy located 25 km to the northeast (closer to shore) than the offshore array area, indicate that the significant wave height is generally below 3 m, with occasional events of 4 m or greater in winter months, and a peak direction of predominantly 240-260º (southwesterly; Cefas, 2020).

Within Milford Haven, the SEACAMS2 Dale Roads WaveRider buoy indicated that the significant wave height generally remained below 2.0 m with a predominant orientation of 200-220º (south to south-southwesterly; Cefas, 2020).

Figure 5.7 - Significant Wave Heights in the Vicinity of the Scoped Area (Source: ABPmer, 2019; Cefas 2020)



5.1.4.2 *Tides*

Tides in the region flow from the west-northwest to east-southeast on the flood and reverse in direction on the ebb. They are semi-diurnal (i.e. there are 2 low waters and 2 high waters each day) and are predominantly rectilinear (i.e. there is little movement at right angles to the main flow direction). Figure 5.8 indicates that at the proposed offshore array area, peak mean spring tidal current speeds are in the region of 0.37-0.61 m/s at springs, with peak mean current speeds increasing closer to shore. RWE (2012) support this stating that the peak tidal flow for flood and ebb are 0.4 -0.6 m/s for the project site. Figure 5.9 shows the peak mean neap tidal current speeds at the proposed site are in the region of 0.19-0.32 m/s, with the peak mean current speeds again increasing closer to shore. Uncles and Stephens (2007) indicate a potential tidal excursion distance of up to 25 km during a flood or ebb tide within the Bristol Channel. In the vicinity of the offshore array area tidal diamond data indicate that the tidal excursion is in the region of 3 km, well within the 10 km SIZ previously advised by NRW.

The mean spring-tide tidal range along the region's coastlines is generally high, ranging from more than 8 m in the northeastern parts of the Bristol Channel, to about 4 m, or less, northeast of the St George's Channel. The mean spring tidal range at Freshwater West is approximately 7 m. The UK Renewable Atlas (ABPmer, 2019) indicates the mean spring tidal range at the Project site is between 4.27-5.58 m.

Mean spring and neap astronomical tidal current velocities in areas close to the offshore array area are also available from Tidal Diamond data on UK Hydrographic Office Admiralty Charts. The closest Tidal Diamond to the offshore array area is Tidal Diamond P, 6 km to the southwest. Table 5.2 shows the current speeds and directions for Tidal Diamond P.

Table 5.2 - Current Speeds and Directions for Tidal Diamond P, 6 km to the Southwest of the Offshore Array Area

Time relative to High Water (hrs)	Current Direction (º)	Spring current speed (m/s)	Neap current speed (m/s)
-6	040	0.6	0.3
-5	007	0.6	0.3
-4	326	0.6	0.3
-3	304	0.7	0.3
-2	283	0.7	0.3
-1	258	0.6	0.3
0	215	0.6	0.3
1	179	0.7	0.3
2	148	0.6	0.3
3	123	0.6	0.3
4	102	0.6	0.3
5	079	0.5	0.3
6	049	0.5	0.3

Tidal water levels can be modified by storm surges, which occur when deep atmospheric depressions move through the area. Uncles and Stephens (2007) suggest that these may increase water levels by over 1.0 m, as an extreme value, during a 50-year return period.

Changes to sea level may change over the life cycle of the project, and as such by 2050, it is predicted that within the Outer Bristol Channel, the relative sea level may potentially rise by up to 0.32 m above 2012 levels (values taken at Ilfracombe from the United Kingdom Climate Projections 2009 (UKCP09) medium emissions scenario) (RWE, 2012).

Figure 5.8 - Peak Mean Spring Tide Current Speed in the Vicinity of the Scoped Area and Wider Area (Source: ABPmer, 2019)

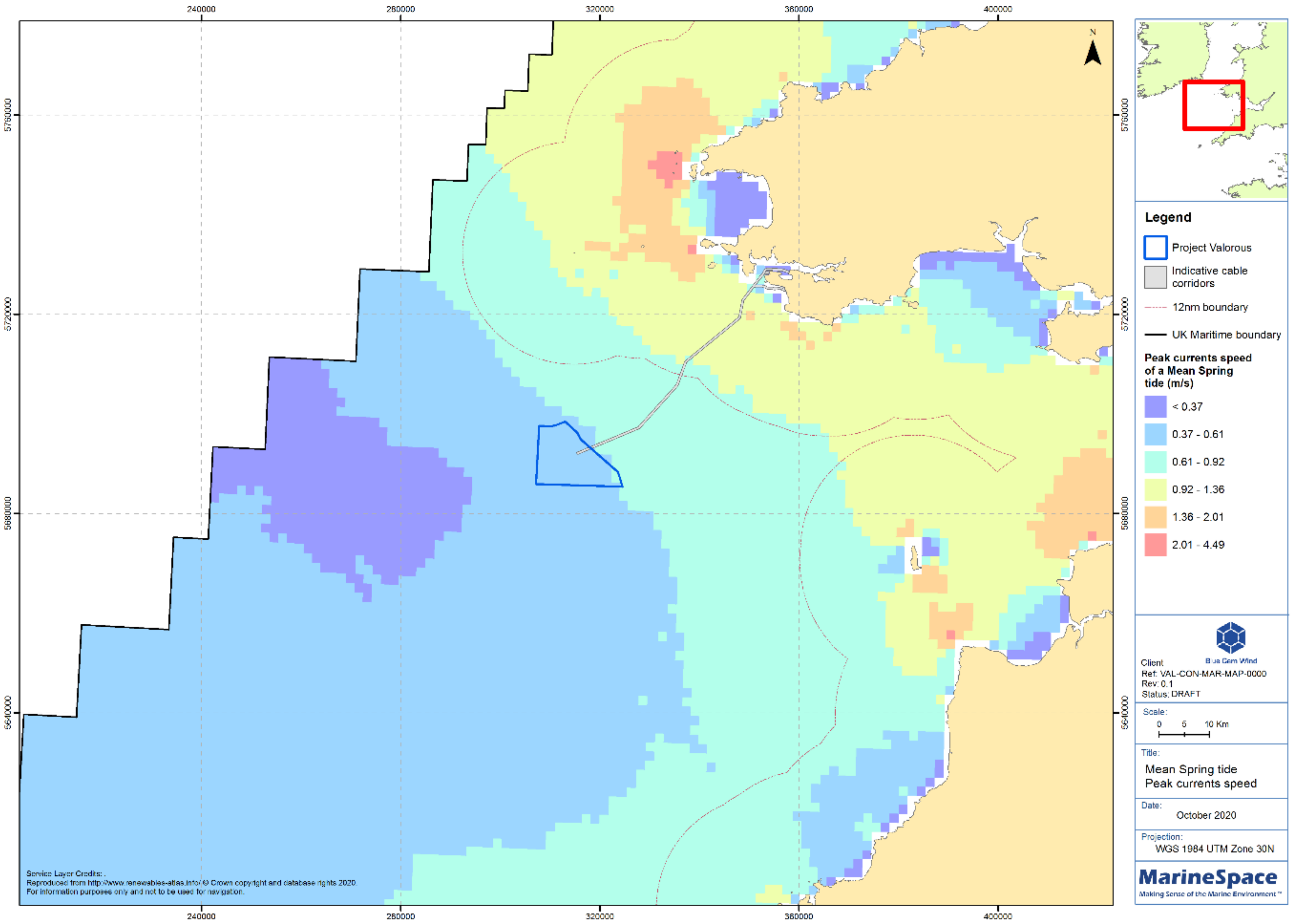
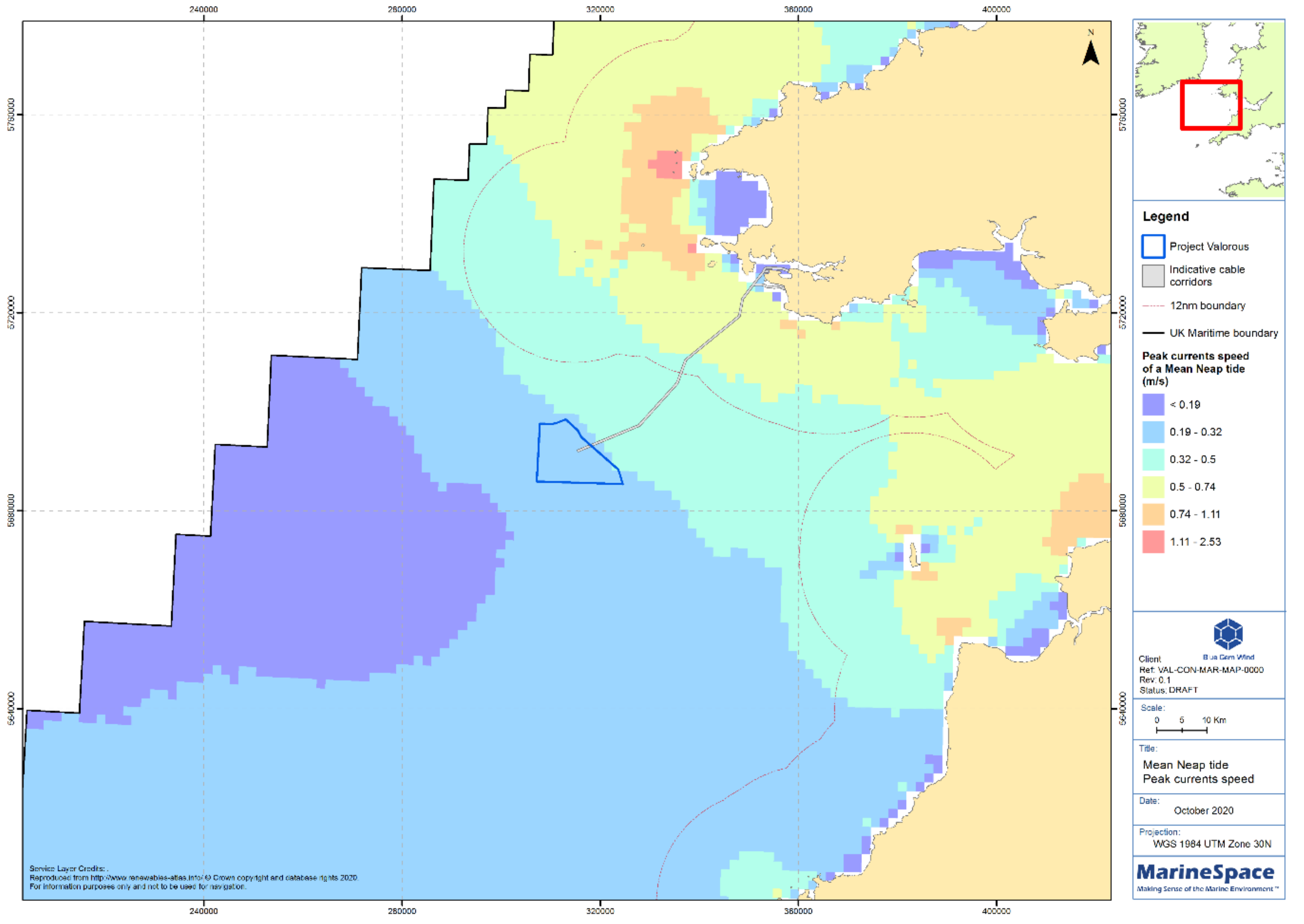


Figure 5.9 - Peak Mean Neap Tide Current Speed in the Vicinity of the Scoped Area and Wider Area (Source: ABPmer, 2019)

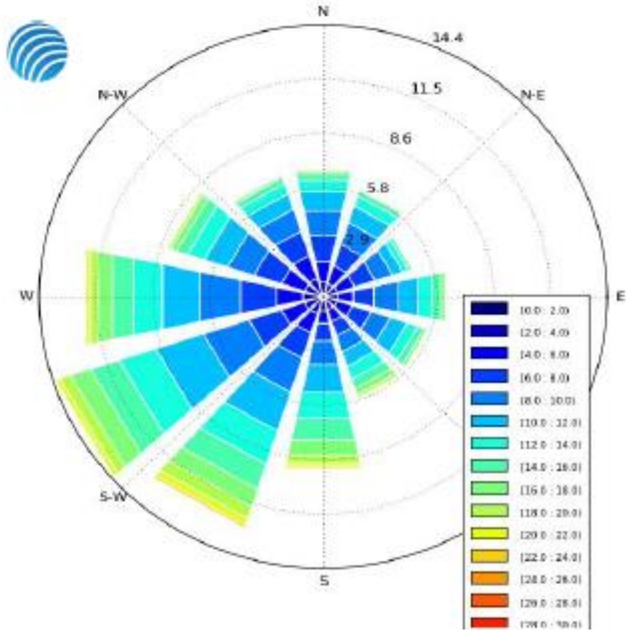


5.1.4.3 Wind

A desk-based assessment of metocean conditions for nearby Project Erebus (Wave Venture, 2020) reached the following indicative conclusions with respect to wind conditions in the area (all values presented as for 110 m above sea level, i.e. reference hub height):

- Mean wind speed: 9.78 m/s (standard deviation: 3.61);
- Long term wind direction (by wind energy): 226º (southwesterly).

Figure 5.10 - Wind Rose of Long-Term Wind Direction and Speed (Hub Height) (From: Wave Venture, 2020)



5.1.5 Sedimentary Processes Baseline

Unconsolidated sediments in the vicinity of the proposed project site may be mobilised and transported by the prevailing local hydrodynamics (waves and/or tidal currents). Information in SEA8 Technical Report – Hydrography (Uncles and Stephens, 2007) suggests that detailed sediment transport processes in St George's Channel are poorly understood but are dominated by tidal currents, rather than waves (DTI, 2007) especially offshore (RWE, 2012). DTI (2007) also indicates that strong tidal currents present around the Pembrokeshire coast suspend high levels of seabed particles in the water column.

Collins (1987) and RWE (2012) concluded that, within the Bristol Channel, sediment transport occurs in an upstream (easterly) direction along the coast (i.e. it is flood dominated) while sediment movement is seawards (westwards) within the central part of the Channel (i.e. ebb dominated). RWE (2012) identify a bedload parting in the sediment transport pathway within the Inner Bristol Channel, approximately between Breaksea Point (to the north) and Bridgwater Bay (to the south). This and DTI (2007) reports that this results in a scoured central region, with exposed bedrock in much of the central section of the Bristol Channel; with sediment thickness generally increasing to either side where bedforms were present, especially to the north.

The Outer Bristol Channel Habitat Study (Mackie *et al.*, 2006) also confirms the Collins (1987) hypothesis, suggesting a northward change in sediment type and increase in bedforms from Lundy Island northward. West and east of Lundy Island, the seabed sediment is coarse grained, gravelly sand and sandy gravel with sand patches, ribbons and waves and isolated sand waves on outcropping bedrock. Northward, within and north of the scoped area, there is sand that forms sand waves up to 10 m high.

Intertek (2019) summarises the high-resolution bathymetry data available in the vicinity of the scoped area, and within a wider area inshore of the proposed offshore array area. Figure 5.1 and Figure 5.2 show the presence of significant areas of subaqueous dunes to the north and northeast of the offshore array area. The crests of these bedform features are, typically, oriented southwest-northeast or north-south and their asymmetry would suggest an easterly movement of sediment. Intertek (2019) indicates that these subaqueous dunes have heights of between 10-15 m and wavelengths of several hundreds of metres. Further east, in deeper water to the south of Carmarthen Bay, there is an extensive sand wave field (Mackie *et al.*, 2007). The asymmetries of these bedforms suggest a westerly sediment transport in this central part of the Bristol Channel (Mackie *et al.*, 2007; Intertek, 2019). Where subaqueous banks were seen inshore, they appeared to have a slightly different sediment transport system, where the asymmetry of the subaqueous dunes indicated circulatory sediment transport around the banks as gyres (Intertek, 2019), which RWE (2012) linked to the presence of headlands along the coast.

The EIA Scoping Report for the Greenlink cable (Intertek, 2018) indicates active sediment transport close to the beaches of the area, with tidal and longshore sediment movement covering and exposing a fossil forest on the beach at Freshwater West. Due to the presence of a sandbank off the beach at Freshwater West, Intertek (2018) also speculates that there may be a sediment transport pathway between the beach and the sandbank. The Scoping Report for the META project (RPS Energy, 2018) indicates that sediment transport along the frontage of the south shore of the Milford Haven waterway is generally from west-east.

5.1.6 Identification of Key Sensitivities and Potential Impacts

Table 5.3 provides a summary of the potential impacts arising from the project on physical process receptors.

5.1.7 Potential Mitigation Measures

It is expected that any impacts on the offshore physical and sedimentary processes will be of small spatial and temporal scale (localised and temporary). Therefore, no additional mitigation measures are expected.

5.1.8 Proposed Approach to Environmental Assessment

Assessment of potential impacts on physical processes from the proposed Project Valorous will be undertaken via the steps detailed below:

- Review of existing relevant baseline data, information and guidance (to include Shoreline Management Plans; Regional Marine Processes data/reports; relevant local publicly available data and guidance such as Brooks *et al.* (2018));
- Acquisition of additional project-specific data to fill any gaps (see Table 5.4 below);
- Formulation of a conceptual understanding of baseline conditions;
- Consultation and agreement with the regulators regarding proposed assessment approaches;
- Determination of the worst-case scenarios based on the agreed Project Design Envelope;
- Consideration of embedded mitigation measures; and

- Assessment of effects using data analysis and expert-based judgements by the EIA consultant team. The approach to assessment will be discussed with regulators and weighted against the potential physical process impacts.

Table 5.3 - Key Sensitivities and Potential Impacts to Marine Coastal Processes

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rational for Impact Scoped In/Out
Sediment Transport (Hydrodynamics)	Changes to sediment transport system by changes in wave and current climate.	Construction Operational Decommissioning	Yes	Changes in hydrodynamic conditions are possible as a result of construction and / or presence of structures within the scoped area. While local changes are possible, it is not expected that there would be a significant change from baseline regional hydrodynamic conditions and, thus, little effect on baseline sediment transport. This will be assessed and confirmed through the EIA.
Coastal Erosion	Potential changes in sediment transport at the coast.	Construction Operational Decommissioning	Yes	Changes to local hydrodynamic regime, for example, changes to tidal energy and wave directions may result in changes to the coastal erosive regime. While this is unlikely, due to the importance of the receptor this will be scoped into the EIA.
Seabed Morphology	There is potential to modify the morphology of the seabed as a result of anchoring structures at the site or resulting from cable lay along the export route.	Construction Operational	Yes	Placement of anchoring or cable protection (if required) on the seabed may have the potentially to locally alter hydrodynamics, potentially causing scour and associated alterations to seabed morphology. It is not expected that there will be a significant change to baseline conditions, however this will be reviewed and confirmed during EIA.
Sediment Transport	Cable lay or anchor placement into mobile seabed, or their removal during decommissioning, or any drilling into hard substrate, if required, may produce additional suspended particles which may become part of the local sediment transport regime.	Construction Decommissioning	Yes	Levels of additional sediment generated as part of the construction or decommissioning are expected to be negligible / Low when compared with the baseline local and regional sediment transport, and of a temporary duration, however this will be reviewed and confirmed during EIA.

Consideration of the potential impacts of the proposed Project will be carried out over the following spatial scales:

- Near-field: the area within the immediate vicinity (tens or hundreds of metres) of the proposed Project and along the offshore cable area;
- Far-field: the wider area that might also be affected indirectly by the proposed Project (e.g. due to disruption of waves, tidal currents or sediment pathways).

Potential impacts will be divided into and presented as 2 main categories:

- Those that directly affect receptors which possess their own intrinsic morphological value, e.g. change in local bedform features and subsequent effect on sediment transport;
- Those that result in effects (or changes) in the baseline metocean conditions and coastal processes which then manifest as impacts upon other (i.e. ecological) receptors, e.g. increased suspended sediment loads leading to impact on shellfish.

3 main phases of development are considered, in conjunction with the present-day baseline, over the life-cycle of the Project. These are:

- Construction phase;
- Operation and maintenance phase;
- Decommissioning phase.

Table 5.4 summarises the proposed surveys that would be undertaken to inform the physical processes assessment.

Table 5.4 - Proposed Surveys to Inform the Physical Process Assessment

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Geophysical (multibeam bathymetry; sidescan sonar; sub-bottom profiler, magnetometer). Will include grab samples for particle size analysis and potentially drop-down video to ground-truth sidescan sonar data.	Minimum 50% coverage of the offshore array area plus proposed 1km buffer (preference for ≥100%). Minimum 100% coverage of export cable corridor up to landfall.	Summer 2022 (TBC)	To gather site-specific data on bathymetry, seabed sediments, morphology/bedforms, sub-bottom geology and potential UXO. Data will be used to inform EIA process, in particular the following topic areas: • Marine Physical Processes; • Marine Ecology; • Marine Archaeology; and • UXO / Other Marine Users.

5.2 Marine Sediment Quality and Water Quality

5.2.1 Study Area

Due to the potential local and regional effects on marine sediment quality and water quality, the Study Area for this section of the Scoping Report comprises a portion of St George's Channel and the northwestern Bristol Channel running into the southwestern coast of Pembrokeshire. The recent NRW advice on a marine aggregates Plan-level HRA indicating a potential tide-parallel Secondary Impact Zone (SIZ) of up to 10 km in each direction is relevant for marine sediment and the Study Area shown in Figure 5.1 is also relevant for this receptor.

5.2.2 Baseline Data

A range of baseline data sources have been used to compile this Section of the Scoping Report, including

- ABPmer, 2019. Atlas of UK Marine Renewable Energy – information of wind, waves and tides;
- British Geological Survey (BGS), 2017a; 2017b - geological units, Quaternary deposits and seabed sediments;
- Cefas, 2019. WaveNet - real time data from the SEACAMS PDZ WaveRider buoy;
- DTI, 2007. Offshore Oil and Gas Strategic Environment Assessment (SEA) 8 Overall Report and associated specialist reports;
- EMODnet – Sea Floor Geology (2020a) and seabed substrate (2020b) information ;
- Intertek Ltd, 2018. Greenlink Interconnector Environmental Scoping Report - UK Marine Route. Rev 2;
- Intertek, 2019. Erebus Stage 1 Floating Windfarm Geological Desk Top Study;
- Mackie *et al.*, 2006. The Outer Bristol Channel Marine Habitat Study;
- NRW, 2017a. Water Framework Directive (WFD) online information;
- RPS Energy, 2018. Marine Energy Test Area (META) Environmental Impact Assessment Scoping Report;
- RWE, 2013. Atlantic Array Offshore Wind Farm Environmental Statement Volume 3: Offshore Annexes;
- UKHO and Admiralty Charts - bathymetry and Tidal Diamond data; and
- Wave Hub Ltd, 2018. Pembrokeshire Demonstration Zone Feasibility Study Environmental Scoping Report.

5.2.3 Existing Baseline

5.2.3.1 Marine Sediment Quality

Seabed sediments off the west coast of Wales predominantly consist of sandy gravel with nearshore areas of sand (DECC 2016). The inshore seabed around the south Pembrokeshire coast is characterised by rocky reef, shoals and sandbanks. Benthic substrates within Milford Haven waterway include a high proportion of hard substrates within central areas, flanked by thick sheltered mudflats supplied by river accumulations (RPS, 2018). BGS seabed sediment data, summarised in Intertek (2019), and shown in Figure 5.5, shows the seabed in the vicinity of the of the proposed offshore array area to primarily consist of sand, with increased amounts of gravel in sediments closer to the coast. The physical properties of the sediments are important because fine muddy sediments are associated with increased risk of containing/taking up contaminants (due to a relatively large surface area and greater cation exchange capacity) in relation to coarser sediments, such as sand and gravel.

The ES for the Atlantic Array Offshore Wind Farm (RWE, 2013) reported on sediment quality data collected to inform the EIA. In recognition of the higher potential for contamination in fine-grained sediments, the Atlantic Array sampling and testing concentrated on areas of fine sediment within their site, as well as inshore sections of their proposed cable route. Results indicated that chemical contaminant concentrations were low; and no samples exceeded Cefas Action Level 1 values for metal contamination used in the assessment. In addition, Total Hydrocarbon Content (THC) results indicated no levels of THC contamination above Cefas Action Level 1. Concentrations of hydrocarbons such as polycyclic aromatic hydrocarbons (PAH) in offshore samples and from the south coast of Pembrokeshire are known to show high variability between sites. However, levels are predominantly below Canadian Council of Ministers of the Environment Interim Sediment Quality Guidelines (ISQG) threshold levels, below which adverse biological effects are not expected during an indefinite period of exposure (MMT, 2019).

Intertek (2018) indicate that polychlorinated biphenyls (PCBs) concentrations are decreasing across the Celtic and Irish Sea but are highest in industrialised regions such as harbours. Tributyltin (TBT) is a widespread contaminant of coastal waters and sediments due to its use an antifoulant on marine structures and shipping. OSPAR (2010) reports suggest that levels of TBT are acceptable across the Celtic Sea but there are still areas of high concentrations such as harbours and shipping lanes (UKMMAS 2010).

5.2.3.2 **Marine Water Quality**

There is no site-specific information on water quality. However, the offshore array area has a dynamic hydrological regime with a varied wave regime and a strong tidal regime that provides the site with high levels of mixing and dispersal. It is therefore anticipated that water quality offshore will be good.

The EU Marine Strategy Framework Directive adopted in 2008 requires that the UK takes "*the necessary measures to achieve or maintain Good Environmental Status in the marine environment by the year 2020 at the latest*" (UKMMAS, 2010). There is a requirement for monitoring of near-shore waters under the EU Water Framework Directive (WFD) with a requirement to report on the 'ecological status' of surface and ground water in coastal waters (out to 1 nm from the baseline) and 'chemical status' of surface and ground waters in territorial waters (out to 12 nm from the baseline). The scoped area overlaps with the Western Wales River Basin District. Assessment of water quality will make consideration of WFD water bodies; and any relevant outputs will be fed through to the WFD assessment.

Water quality, defined in terms of bacterial concentration, is monitored in Bathing Waters designated under the revised Bathing Water Directive (2007/7/EC), and many of the beaches within the scoped area have been assessed as having excellent water quality for the last 4 years (NRW, 2020). Water quality is also monitored for shellfish waters, initially designated under the Shellfish Waters Directive 79/923/EEC and incorporated into The Water Framework Directive 2000/60/EC as protected area, following repeal of the Shellfish Waters Directive in 2013. Currently, the nearest shellfish water protected area to the scoped area is to the northeast at the Milford Haven Cleddau.

Intertek (2018), in the Scoping Report for the Greenlink interconnector, reports that dissolved contaminants in the Celtic Sea, and off the Pembrokeshire coast, are low or below the level of detection for current analytical tools. Coastal waters contain the highest concentrations of contaminants as they are within close proximity to run off from industry, however contamination along the south Pembrokeshire coast does not exceed environmental quality standards (EQSs) for metals and Maximum Allowable Concentrations for alkylphenolic chemicals.

5.2.4 Identification of Key Sensitivities and Potential Impacts

Table 5.5 provides a summary of the potential impacts arising from the project on the marine sediment and water quality.

5.2.5 Potential Mitigation

Mitigation measures dealing with the risk of accidental spills are suggested, with risks managed through the implementation of industry standard best practice guidelines; for example, appropriate use of chemicals, establishment of spill response procedure, marine pollution contingency plans and pollution prevention guidelines (PPGs). It is expected that adoption of these mitigation measures will ensure that the risk of pollution is not deemed to be significant.

Project vessels will comply with the International Maritime Organisation (IMO) International Convention for the Prevention of Pollution from Ships (MARPOL) standards.

No further mitigation is suggested at this stage.

5.2.6 Proposed Approach to Environmental Assessment

The assessment of impacts on marine water and sediment quality will follow the general methodology as set out in Section 5.1. The first stage in the assessment of potential impacts on marine water and sediment quality will be to determine the baseline conditions of the marine water (i.e. the current background contaminant levels and concentrations of suspended sediments) and the sediments (in terms of physical properties and contamination). Information on sediment PSA will be applied to determine risk of sediments containing / taking up contaminants. The Project team will look to engage with NRW advisory and JNCC, at an early stage, for discussions on how baseline conditions should be characterised.

Potential effects on marine water and sediment will then be compared against existing baseline conditions and potential impacts will be assessed in relation to natural variation, the scoped area characteristics, spatial and temporal scales. The Project team will look to engage with NRW advisory and JNCC, at an early stage, for discussions on the methodology for this assessment.

The assessment to consider the potential effects of sediment resuspension associated with hydrodynamic changes or direct resuspension due to works operations will use the outputs of the additional data collection proposed to be undertaken to inform the marine coastal processes chapter of the EIA. Due to the low risk of contamination associated with the coarse-grained sediments (sands and gravels) found offshore at the proposed array site, no additional marine sediment and water quality data collection is proposed for the offshore array areas. The Project team will look to engage with NRW advisory and JNCC, at an early stage, for discussions on requirements for marine sediment and water quality data collection in inshore waters.

Table 5.5 - Key Sensitivities and Potential Impacts for Marine Sediment and Water Quality

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rational for Impact Scoped In/Out
Water Quality (Suspended Sediment)	Construction and decommissioning activities including drilling of anchors and offshore substation into hard rock seabed, or their removal during decommissioning, cable installation and HDD may produce additional suspended particles which may become part of the local sediment transport regime.	Construction Decommissioning	Yes	Increased suspended sediments leading to smothering of surrounding habitats or a release of contaminated sediments is very unlikely in a strongly tidal area. If an increase in suspended sediments does occur, this will be rapidly dispersed due to tidal flows. The tidal flows will also reduce any smothering potential due to increased dilution and dispersion rates.
Water Quality (Suspended Sediment)	Changes to sediment transport system caused by changes in wave and current climate.	Construction Operational Decommissioning	Yes	Increased suspended sediments leading to smothering of surrounding habitats, or a release of contaminated sediments as a result of changes in hydrodynamics, is very unlikely in a strongly tidal area. If an increase in suspended sediments does occur, this will be rapidly dispersed due to tidal flows. The tidal flows will also reduce any smothering potential due to increased dilution and dispersion rates.
Water Quality (Chemical Contamination)	There is the potential for accidental release of fluids into the environment through construction, operational and decommissioning phases.	Construction Operational Decommissioning	Yes	The risk of this is managed through the implementation of industry standard best practice guidelines, for example, appropriate use of chemicals, spill response, marine pollution contingency plans and guidance for pollution prevention (GPPs); therefore, the risk of pollution is not deemed to be significant.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rational for Impact Scoped In/Out
Sediment Quality (Contamination of Marine Sediments)	There is the potential for accidental release of fluids into the environment through construction, operational and decommissioning phases.	Construction Operational Decommissioning	Yes	Industry standard best practice guidelines will be followed at all times, for example, appropriate use of chemicals, emergency response, marine pollution contingency plans and GPPs, (in particular GPP1 and GPP5); therefore, risk of contamination is not deemed to be significant.
Bacteria	The introduction of transmission cables into the marine environment may influence growth of temperature responsive bacteria.	Operation	Yes	Any temperature increases from transmission assets are expected to be very small and highly localised. It is anticipated that the potential influences on bacterial growth rate will be negligible.
Bathing Waters and Shellfish Water - Bathing Waters: Freshwater West - Bathing Waters: West Angle	There is potential for any of the impact pathways identified above to result in adverse effects on water quality of designated bathing waters.	Construction Operational Decommissioning	Yes	The risk of changes in water quality of a magnitude sufficient to impact classification of designated water bodies is considered very low. Any changes in water quality are likely to be highly localised, and it is expected that strong tidal flows in the region will prevent any change from being detectable at designated bathing water sites.

5.3 Intertidal / Onshore Geology, Geomorphology and Soils

5.3.1 Study Area

The Project will include up to 2 marine export cables which will make landfall at a location to be determined. Therefore, the Study Area for the intertidal / onshore geology, geomorphology and soils encompasses all potential landfall locations in the Castlemartin peninsula, from the Milford Haven waterway in the north to Bosherston in the south.

5.3.2 Baseline Data

A range of baseline data sources has been used to compile this section of the Scoping Report, including:

- British Geological Survey (BGS), 2017a; 2017b - geological units, and Quaternary deposits;
- Halcrow, 2012. South Wales Shoreline Management Plan;
- Greenlink Interconnector Ltd, 2019. Greenlink Interconnector Marine Environmental Statement – Wales.
- RPS Energy, 2018. Marine Energy Test Area (META) Environmental Impact Assessment Scoping Report; and
- Wave Hub Ltd, 2018. Pembrokeshire Demonstration Zone Feasibility Study Environmental Scoping Report.

Table 5.6 sets out the designated geological sites that have been identified within the scoping study area.

5.3.3 Existing Baseline

The region around St Govan’s Head is primarily comprised of sedimentary bedrock formed approximately 326 to 359 million years ago in the Carboniferous Period, although to the north of St Govan’s Head, Ordovician, Silurian, and Devonian-age rocks all make up elements of the south Pembrokeshire geology (Figure 5.11).

The coastline between Giltar Point and St Govan’s Head is largely undeveloped, and characterised by rocky cliffs fronted by narrow rocky platforms with a series of indented sheltered embayments, or pocket beaches, within which sediment tends to accumulate. In places, these beaches are backed by dunes, such as at Freshwater East, Barafundle Bay and Stackpole Warren (Halcrow, 2012) and much of the landscape is designated. Halcrow (2012) indicates that the key policy driver for this frontage is to enable the natural evolution of the coastline, to preserve its environmental interest and the tourist economy it supports, and while along the undeveloped sections of the coast the policy is no active intervention, a policy of managed realignment will be adopted for the dune system at Freshwater East to enable natural functioning.

Table 5.6. Designated Geological Sites within Scoping Study Area

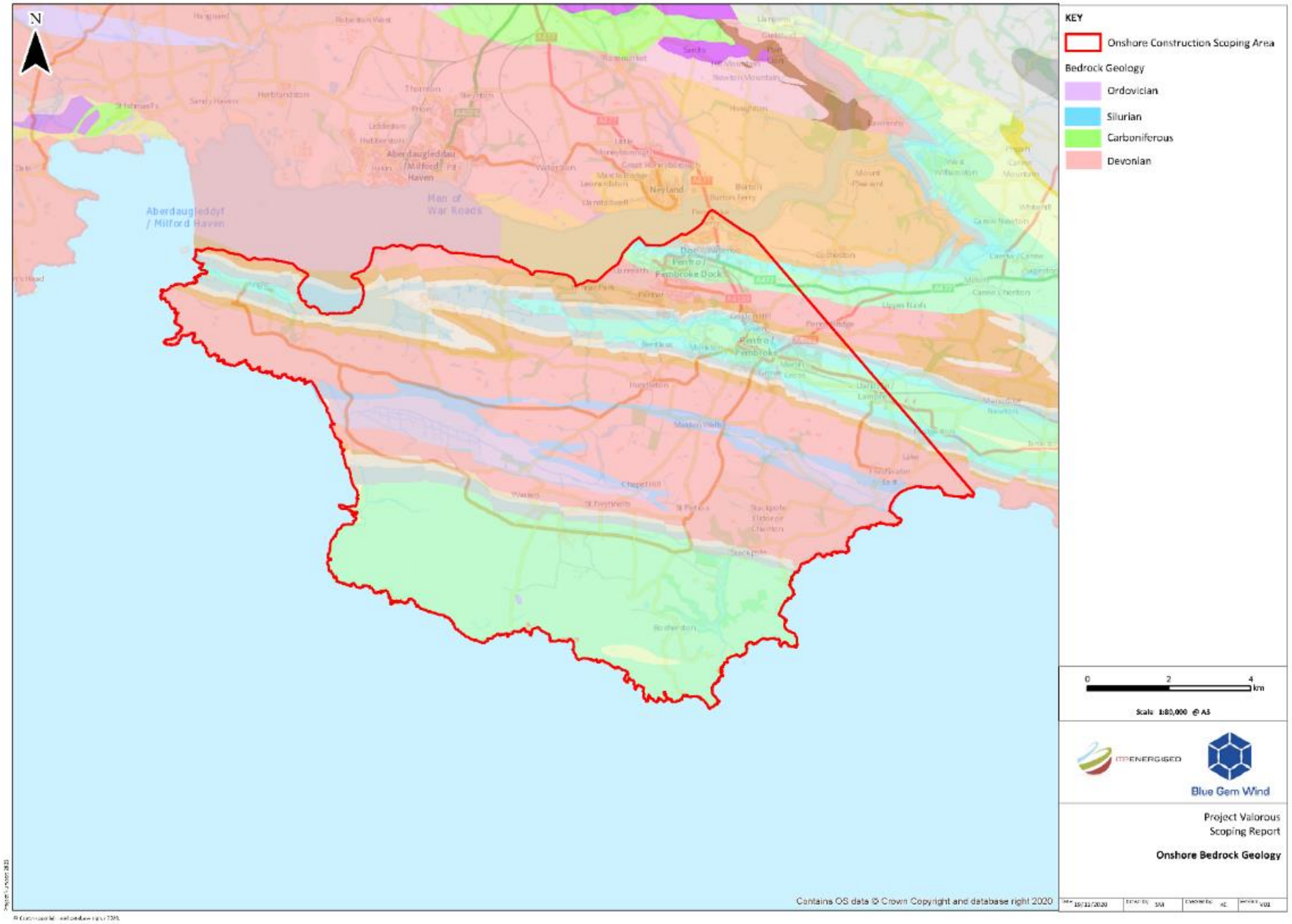
Site Code	Name	Location	Reason for Consideration
Regionally Important Geological Site (RIGS)			
453	East Pickard Bay RIGS	Overlaps with the Study Area (possible cable route); approx. 41 km from offshore array.	Within the Study Area, noted for stratigraphy (igneous, Devonian).
483	Sawdern Point RIGS	Overlaps with the Study Area (possible cable route); approx. 44 km from offshore array.	Within the Study Area, noted for stratigraphy (Devonian).
482	Townsend	Overlaps with the Study Area	Within the Study Area and noted for geological features
485	Mullock Bridge	Overlaps with the Study Area	Within the Study Area and noted for geological features
488	West Angle Bay RIGS	Overlaps with the Study Area (possible cable route); approx. 41 km from offshore array.	Within the Study Area, noted for stratigraphy and structure (Carboniferous; Variscan).
479	Sandy Haven	Overlaps with the Study Area	Within the Study Area and noted for geological features
501	Caled Quarry Bosherston RIGS	Overlaps with the Study Area (possible cable route); approx. 48 km from offshore array.	Within the Study Area, noted for stratigraphy and structure (Lower Carboniferous).
502	Westdale Bay	Overlaps with the Study Area	Within the Study Area and noted for geological features
519	Longstone Down RIGS	Overlaps with the Study Area (possible cable route); approx. 44 km from offshore array.	Within the Study Area, noted for Quaternary geomorphology and Holocene geomorphology.

Site Code	Name	Location	Reason for Consideration
520	Bullslaughter Bay RIGS	Overlaps with the Study Area (possible cable route); approx. 46 km from offshore array.	Within the Study Area, noted for stratigraphy, Quaternary geomorphology and structure (Carboniferous, possible Triassic and Variscan).
529	New Quay RIGS	Overlaps with the Study Area (possible cable route); approx. 48 km from offshore array.	Within the Study Area, noted for Quaternary geomorphology and Holocene geomorphology.
536	Monk Haven	Overlaps with the Study Area	Within the Study Area and noted for geological features
555	Middle Cove RIGS	Overlaps with the Study Area (possible cable route); approx. 51 km from offshore array.	Within the Study Area, noted for stratigraphy (Carboniferous).
556	Stackpole Head RIGS	Overlaps with the Study Area (possible cable route); approx. 50 km from offshore array.	Within the Study Area, noted for geomorphology (karst).
561	Angle Bay RIGS	Overlaps with the Study Area (possible cable route); approx. 43 km from offshore array.	Within the Study Area, noted for stratigraphy (Carboniferous).
Geological Conservation Review (GCR)			
1734	Albion Sands & Gateholm Island	Overlaps with the Study Area	Within the Study Area and noted for geological features.
1759	Blucks Pool - Bullslaughter Bay GCR	Overlaps with the Study Area (possible cable route); approx. 41 km from offshore array at closest point.	Within the Study Area, noted for Dinantian geology.
1732	Little Castle Head	Overlaps with the Study Area	Within the Study Area and noted for geological features.
43	Freshwater East (northeast) GCR	Overlaps with the Study Area (possible cable route); approx. 55 km from offshore array.	Within the Study Area, noted for Palaeozoic palaeobotany.

Site Code	Name	Location	Reason for Consideration
954	Freshwater East (southwest) GCR	Overlaps with the Study Area (possible cable route); approx. 54 km from offshore array.	Within the Study Area, noted for Wenlock geology.
1657	Freshwater East (north) GCR	Overlaps with the Study Area (possible cable route); approx. 55 km from offshore array.	Within the Study Area, noted for Variscan structures.
3228	Freshwater West GCR	Overlaps with the Study Area (possible cable route); approx. 42 km from offshore array.	Within the Study Area, noted for non-marine Devonian geology.
1663	Freshwater West (North) GCR	Overlaps with the Study Area (possible cable route); approx. 42 km from offshore array.	Within the Study Area, noted for Variscan structures.
1666	Freshwater West (South) GCR	Overlaps with the Study Area (possible cable route); approx. 42 km from offshore array.	Within the Study Area, noted for Variscan structures.
953	Marloes	Overlaps with the Study Area	Within the Study Area and noted for geological features.
1660	Marloes Sands to Albion Sands	Overlaps with the Study Area	Within the Study Area and noted for geological features.
1913	South Pembroke Cliffs GCR	Overlaps with the Study Area (possible cable route); approx. 44 km from offshore array.	Within the Study Area, noted for coastal geomorphology.
1658	St Ann’s Head	Overlaps with the Study Area	Within the Study Area and noted for geological features.
1656	Stackpole Quay GCR	Overlaps with the Study Area (possible cable route); approx. 51 km from offshore array.	Within the Study Area, noted for Variscan structures.
1735	Tenby Cliffs GCR	Overlaps with the Study Area (possible cable route); approx. 55 km from offshore array.	Within the Study Area, noted for non-marine Devonian geology.

Site Code	Name	Location	Reason for Consideration
1458	West Angle Bay GCR	Overlaps with the Study Area (possible cable route), approx. 41 km from offshore array.	Within the Study Area, noted for Quaternary geology.
1733	West Angle Bay (North) GCR	Overlaps with the Study Area (possible cable route); approx. 41 km from offshore array.	Within the Study Area, noted for non-marine Devonian geology.

Figure 5.11 - Onshore Bedrock Geology in the Region of St Govan's Head, Showing the Extensive Carboniferous Deposits at the South of Peninsula. (From: Halcrow, 2012)



The St Govan's Head to Thorn Island frontage is characterised by limestone cliffs to the south and sandstone cliffs to the north, separated by the dunes at Frainslake Sands and Freshwater West. The shoreline is important for the landscape and habitats it supports, being within the Limestone Coast of South West Wales SAC and Castlemartin Coast SPA, as well as a number of SSSIs. West Angle Bay is a defended frontage, with a short length of seawall reducing the risk of coastal erosion and flooding and the recommended policy along much of this frontage is no active intervention to allow the coastline to evolve naturally and preserve the environmental interest. Halcrow (2012) indicates that within the dune systems at Frainslake Sands and Freshwater West a policy of managed realignment is in place to allow the dunes to function naturally, whilst allowing dune management to be undertaken as required.

The Thorn Island to Cleddau Bridge frontage comprises the southern bank of Milford Haven and includes Angle Bay and Pembroke river upstream to the barrage. Milford Haven is constrained by the resistant geology which provides the main influence on its structure and shape. The area is important for conservation and is part of the Pembrokeshire Marine SAC, as well as encompassing a number of SSSIs. The western (outer) section of the frontage is largely undeveloped, consisting of sandstone cliffs fronted by rocky foreshores, and is within the Pembrokeshire Coast National Park. The policy for the undeveloped frontage is to allow natural evolution of the coastline to continue through no active intervention. The Shoreline Management Plan policy of hold the line is in place between Llanreath (Martello Tower) eastwards to Cleddau Bridge to reduce coastal erosion and flood risk by maintaining and upgrading existing defences (Halcrow, 2012).

West Angle Bay, Angle Bay, Bullslaughter Bay, New Quay, Broadhaven South, and Barafundle Bay are all underlain by Dinantian (Lower Carboniferous) rocks (approximately 331-359 million years old). These rocks are limestones with some interbedded sandstones and argillaceous rocks. The Carboniferous limestones and sandstones were formed in warm shallow seas with carbonates being laid down on platform, shelf and slope areas; often rich in corals and shelly faunas.

Pembroke Dock is underlain by Lower Devonian rocks, approximately 393 to 419 million years old. The Lower Devonian generally comprises an upward coarsening sequence of mudstones, sandstones and conglomerates laid down on an alluvial plain as distal fluvial sediments.

Freshwater West is located in an area of rocks of Ludlow (Silurian) age, approximately 419 to 423 million years old. These rocks are mudstones, siltstones and sandstones and run in a band between Freshwater West and Freshwater East. The depositional environment was different to the Carboniferous limestones, being primarily fluvial, with detrital sand and gravel being deposited in channels, forming river terrace deposits. Some units are likely derived from fine silt and clay from overbank floods forming floodplain alluvium, and ancient peat bogs.

5.3.4 Identification of Key Sensitivities and Potential Impacts

Table 5.7provides a summary of the potential impacts arising from the project on the intertidal / onshore geology, geomorphology and soils.

5.3.5 Potential Mitigation

Construction practices will comply with a Code of Construction Practice (CoCP) to ensure appropriate Pollution Prevention Guidelines (PPG) and good practice guidelines are followed. Potential mitigation measures for the onshore cable construction works will also include avoidance of impact through engineering techniques (e.g. trenchless techniques at sensitive points) where sensitive habitats and receptors are present.

5.3.6 Proposed Approach to Environmental Assessment

The assessment of impacts on intertidal / onshore geology, geomorphology and soils will follow the general methodology as set out in Section 5.1. The first stage in the assessment of potential impacts will be to determine the baseline conditions of these receptors.

In order to inform the EIA baseline, additional data gathering will focus on site-specific description of soils. It is likely that this would be undertaken through a combination of desk review, site visits and walk over survey investigations, although use of an unmanned aerial vehicle (UAV)/drone survey is also possible (Table 5.8). Should any additional geophysical and / or geotechnical data be collected for engineering purposes, these would also be incorporated into the appraisal.

Potential effects on intertidal/onshore geology, geomorphology and soils will then be compared against existing baseline conditions and potential impacts will be assessed against natural variation, the study area characteristics, spatial and temporal scales.

Table 5.7 - Key Sensitivities and Potential Impacts to Intertidal, Onshore Geology and Geomorphology

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Geological Features Regionally Important Geological Sites: East Pickard Bay Sawdern Point West Angle Bay Caled Quarry Bosherston Longstone Down Bullslaughter Bay New Quay Middle Cove Stackpole Head Angle Bay Geological Conservation Review Sites: Blucks Pool - Bullslaughter Bay Freshwater East (northeast, southwest and north)	Damage or disturbance of geological features of interest through installation / removal of infrastructure and associated construction activities.	Construction Decommissioning	Yes	As the exact cable route is currently unknown, there is potential for disturbance of geological features of interest and is therefore scoped in for assessment. It is not anticipated, however, that there will be an impact on geological features from the onshore works. With the exception of the landfall, no significant excavation into the underlying geology would be expected, with any excavations being within surface soils. Landfall installation would either require open trenching or HDD drilling through rock.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Freshwater West (general, north and south) South Pembroke Stackpole Quay Tenby Cliffs West Angle Bay (general and north)				
Geomorphology / Soils	Damage or removal of geomorphological (topographical) and / or soil features.	Construction Decommissioning	Yes	Excavation of the onshore cable route and groundworks for the substation are expected to be predominantly within areas that are already modified. As cable will be buried, it is not anticipated that there would be permanent changes to geomorphology or topography, although there may be temporary disturbance during construction and possibly decommissioning phases. Once buried, the ground level of the cable route would be returned to near baseline conditions. It is not anticipated that there would be an impact on geomorphology or topography. However, the exact cable route is currently unknown and there may be localised impacts requiring further assessment.
Soil	Compaction and degradation of soils.	Construction Decommissioning	Yes	Excavation works during installation of the onshore cable route are likely to disturb surface soils. This can result in compaction and degradation of excavated soils, particularly topsoil. The extent of significance would be influenced by the final locations and construction methodology used. In addition, construction plant activities may also cause compaction of soils in the surrounding working area. Installation in areas of made ground are less likely to result in impacts to surface soils.

Table 5.8 - Proposed Surveys to Inform the Intertidal / Onshore Geology Assessment

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Topographic / UAV Survey	Selected landfall location (MLWS to MHWS).	Summer 2022	To gather topographic data from the proposed landfall location to inform EIA work.

5.4 Onshore Groundwater and Hydrology

5.4.1 Study Area

The project will include up to 2 marine export cables. The exact location of landfall is not yet determined, therefore the Study Area for the onshore groundwater and hydrology assessment encompasses all potential landfall locations and the southwestern part of the Castlemartin peninsula, from the Milford Haven waterway in the north to Bosherston in the south.

5.4.2 Baseline Data

A range of baseline data sources has been used to compile this section of the Scoping Report, including:

- Halcrow, 2012. South Wales Shoreline Management Plan;
- Greenlink Interconnector Ltd, 2019. Greenlink Interconnector Marine Environmental Statement – Wales;
- NRW, 2016. Pembrokeshire Catchment Summary;
- RPS Energy, 2018. Marine Energy Test Area (META) Environmental Impact Assessment Scoping Report;
- Wave Hub Ltd, 2018. Pembrokeshire Demonstration Zone Feasibility Study Environmental Scoping Report; and
- Walkover survey of the area by members of the project team in summer 2020 in association with Project Erebus.

5.4.3 Existing Baseline

The Study Area is underlain by the Pembrokeshire Carboniferous Limestone groundwater body. Halcrow (2012) indicates that this has a Good Status for saline intrusion and Good Status overall. Wave Hub Ltd (2018) indicates that the Pembrokeshire Carboniferous Limestone water body has good water quality and availability. Wave Hub Ltd (2018) also indicates that the southern part of the area is underlain by a bedrock Principal aquifer.

NRW (2016) reports that Dŵr Cymru Welsh Water (DCWW) supplies the area with potable water and also raw water to some industry, and that its major abstractions are at Canaston on the Eastern Cleddau, which provides water for most of South Pembrokeshire, and Crow Hill on the Western Cleddau.

NRW (2016) also notes that Llys y Fran reservoir on the Syfynwy (a tributary of the Eastern Cleddau) is used to regulate flows in the Eastern Cleddau to enable abstraction at Canaston at times of low river flows.

The Study Area contains a number of River Water Bodies:

- Freshwater East Stream – headwaters to tidal limit;

- Bosherston Lily Ponds – headwaters to tidal limit;
- Fraislake Stream - – headwaters to tidal limit;
- Castlemartin Corse – headwaters to tidal limit;
- Angle Stream South – headwaters to tidal limit;
- Angle Stream North – headwaters to tidal limit; and
- Martin’s Haven Pill – headwaters to tidal limit.

Wave Hub Ltd (2018) indicates that Castlemartin Corse is the largest waterway in the Study Area, and that it begins as a series of springs to the west of St Petrox, and flows northwesterly, until it reaches the sea at Freshwater West.

Wave Hub Ltd (2018) also indicates the presence of small lakes in the Study Area, with the largest being formed by 3 flooded valleys at Bosherston, each fed by a small freshwater stream, which make up the Lily Ponds.

NRW flood risk data (2019) shows that flooding risk due to surface runoff is low, and confined to valley floors, while flood risk from fluvial and coastal flooding is also generally low.

5.4.4 Identification of Key Sensitivities and Potential Impacts

Table 5.9 provides a summary of the potential impacts arising from the Project on the onshore groundwater and hydrology.

5.4.5 Potential Mitigation

Mitigation measures to maintain surface water flows during cable installation should be put in place to prevent direct impacts on the hydrology and geomorphology of surface watercourses.

In order to mitigate the effects of sediment entering watercourses, standard sediment management measures could be used, if appropriate; e.g. settlement ponds, covering stockpiles to prevent runoff, silt curtains in watercourses etc.

Mitigation measures dealing with the risk of accidental spills or contaminants are also suggested, with risks managed through the implementation of industry standard best practice guidelines, for example, appropriate use of chemicals, spill response, pollution contingency plans and pollution prevention guidelines (PPGs) and replacement Guidance for Pollution Prevention (GPP) documents.

Table 5.9 - Key Sensitivities and Potential Impacts to Onshore Groundwater and Hydrology

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Hydrology	Changes to hydrology (including private water supplies).	Construction Operational Decommissioning	Yes	The cable route may need to cross hydrological features such as streams or drainage channels. The impacts of this will be dependent on construction methodology, location and nature of hydrological features in the development area.
Surface Water Bodies	Sediment suspended as a result of construction or decommissioning activities may enter surface water bodies.	Construction Decommissioning	Yes	Increased sediment supply could result in localised increases in turbidity and alter sediment deposition patterns and locations downstream of the source point.
Surface Water Bodies and Groundwater	Release of contaminants to surface waters and groundwater.	Construction Decommissioning	Yes	Onshore activities associated with construction and decommissioning works have the potential for accidental release of contaminants which could directly enter surface water bodies or enter the groundwater.
Flood Risk	Alteration to flood risk as a result of onshore works.	Construction Operational Decommissioning	Yes	The onshore works may be located within areas at risk from river, tidal or coastal flooding. The impacts of this will be dependent on construction methodology, location and nature of hydrological features and flood risk zones in the area of works, which is currently unknown. Flood risk (including sea level rise associated with climate change) should therefore be considered further as part of the EIA.

5.4.6 Proposed Approach to Environmental Assessment

In order to inform the EIA baseline, data gathering will focus on:

- Site specific description of soils. It is likely that this would be undertaken through a combination of desk review, and site visits / walk-over survey. Where additional geophysical and / or geotechnical data may be collected for engineering investigations, these would also inform the risk assessment process; and
- Desk-based review of information regarding hydrological features that may be impacted by the Project, including private water supplies. This would include groundwater flow, surface water flow, drainage and flood risk zones.

5.5 Water Framework Directive

5.5.1 Study Area

The Study Area for the WFD assessment includes the southwestern part of the Pembrokeshire peninsula, from the Milford Haven waterway in the north to Bosherston in the south. Given the extent of this assessment, the WFD assessment will draw upon outcomes from the EIA where appropriate and assessment will be aligned with that of the wider EIA where there are topic areas/receptors of relevance.

5.5.2 Baseline Data

A range of baseline data sources have been used to compile this Section of the Scoping Report, including

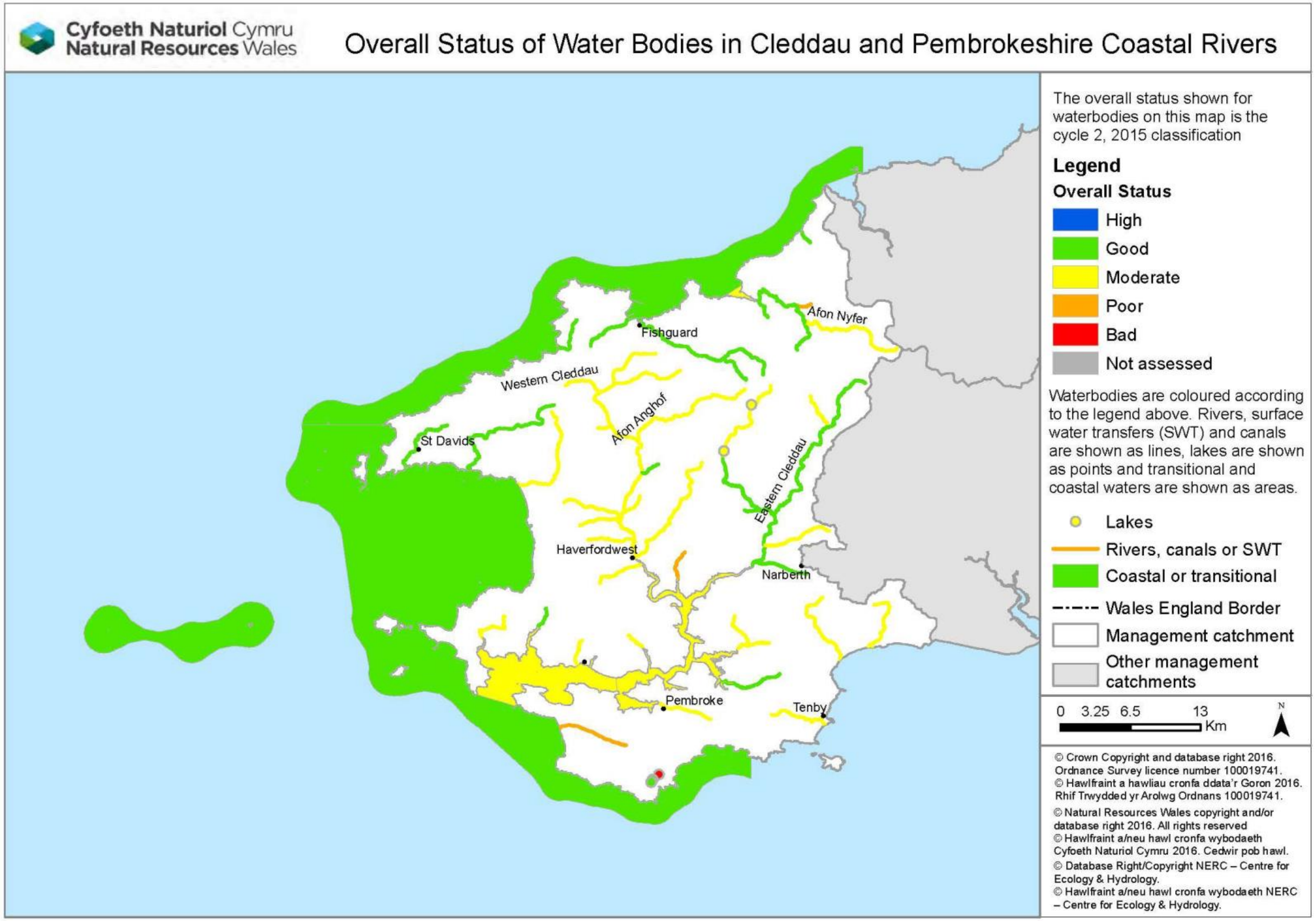
- Halcrow, 2012. South Wales Shoreline Management Plan;
- NRW (Natural Resources Wales), 2016. Pembrokeshire Catchment Summary; and
- NRW (Natural Resources Wales), 2020. Online information for WFD waterbodies and associated Protected Areas.

5.5.3 Existing Baseline

NRW (2016) indicates that within the overall Pembrokeshire catchment, 42% of surface water bodies are at good overall classification status, 51% at moderate, 5% at poor and 2% at bad overall status. There are no water bodies at high overall status (Figure 5.12). NRW (2016) states that the Milford Haven water bodies are sensitive to nutrient pollution.

The offshore array area is not located within a WFD water body, however the potential marine export cable corridor and landfalls may pass through coastal and transitional water bodies, as designated under the WFD, and shown in Figure 5.13.

Figure 5.12 - Overall Status of Water Bodies in Cleddau and Pembrokeshire Coastal Rivers. (From NRW, 2016)



WFD coastal water bodies relevant to the scoped area (see Figure 5.13) are:

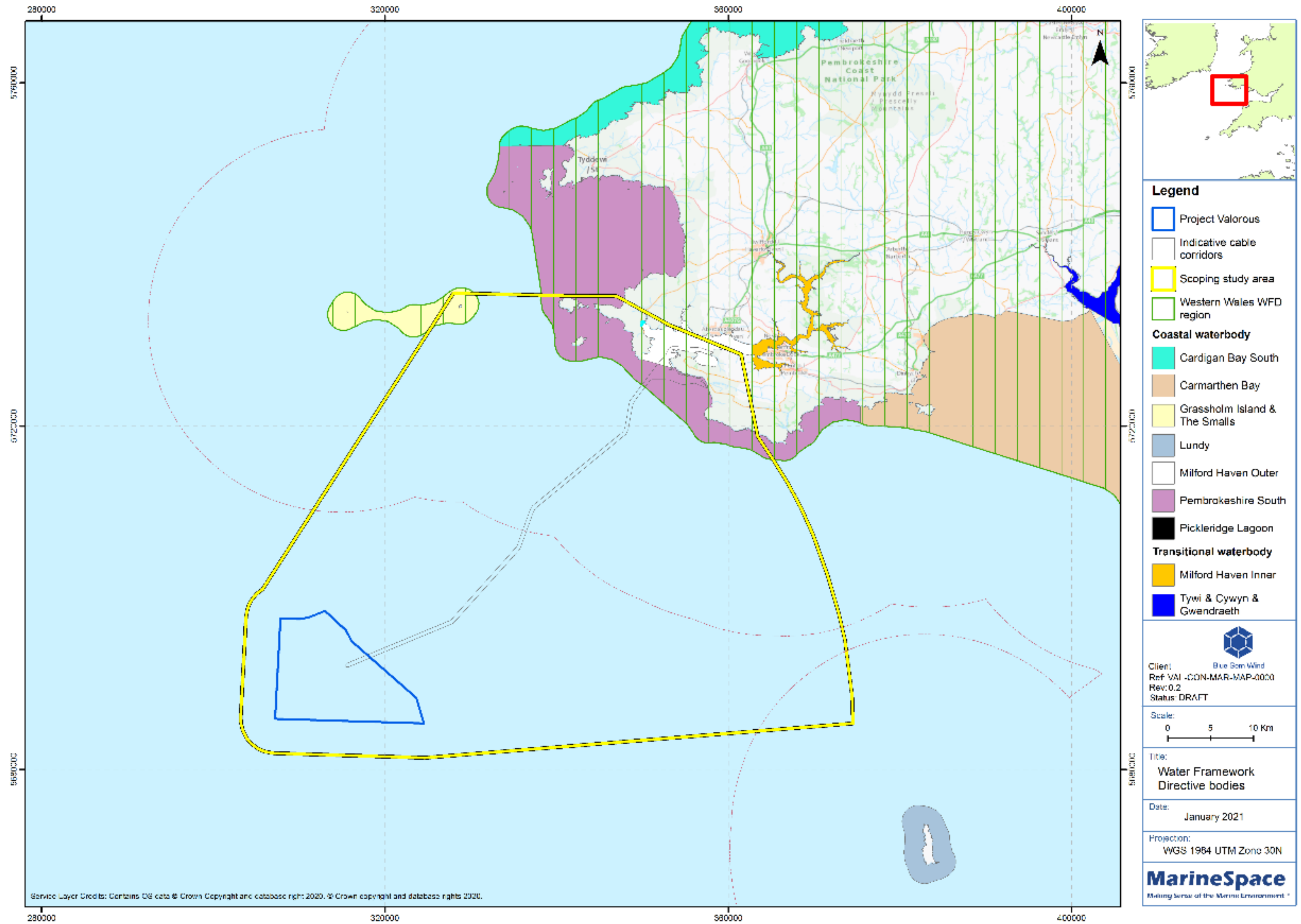
- Milford Haven Inner transitional water body (GB531006114100), which is at Moderate Ecological Status because of high concentrations of mercury and mercury-containing compounds, Tributyltin (TBT), Brominated Diphenylether (BDPE), dissolved inorganic nitrogen, and opportunistic macroalgae growth;
- Milford Haven Outer coastal water body (GB641008220000), which is at Moderate Ecological Status because of high concentrations of dissolved inorganic nitrogen, mercury, and mercury-containing compounds; and
- Pembrokeshire South coastal water body (GB611008590003), which is at Good Ecological Status.

The export cable corridor and landfalls will also pass through the Pembrokeshire Carboniferous Limestone WFD groundwater body (GB41002G206000). This is currently at Good Quantitative Status and Good Chemical Status.

In addition, and by comparison with information presented by Wave Hub Ltd (2018), any export cable corridor and landfalls also have the potential to pass through or close to the catchments of the following river and lake water bodies:

- Castlemartin Corse river water body (GB110061025000) which, because of low dissolved oxygen concentrations and related pressures on macrophytes and macroinvertebrates, is at Poor Ecological Status;
- Bosherston Lily Ponds (Eastern Arm) lake water body (GB31047013) which, because of high total phosphorus concentrations and pressure on macrophytes, phytobenthos and diatom communities, is at Bad Ecological Status;
- Bosherston Lily Ponds (Central Arm) lake waterbody (GB31047014), which is at Good Ecological Status; and
- Bosherston Lily Ponds (Western Arm and Central) lake water body (GB31047015), which is at Good Ecological Status.

Figure 5.13 - Water Framework Directive (WFD) Coastal Water Bodies in the Vicinity of the Scoped Area.



5.5.4 Identification of Key Sensitivities and Potential Impacts

Table 5.10provides a summary of the potential impacts arising from the project on the WFD.

5.5.5 Potential Mitigation

Where appropriate, standard sediment management measures could be used to mitigate the effects of sediment entering water courses, e.g. settlement ponds, covering stockpiles to prevent runoff, silt curtains in water courses etc.

Mitigation measures dealing with the risk of accidental spills or contaminants are also suggested, with risks managed through the implementation of industry standard best practice guidelines, for example, appropriate use of chemicals, spill response, pollution contingency plans and pollution prevention guidelines (PPGs).

5.5.6 Proposed Approach to Environmental Assessment

The overall requirement of the WFD is that all waterbodies must achieve 'Good Status' by a set deadline, as detailed in the respective river basin management plans (RBMP). It also requires that environmental objectives be set for all waterbodies to either maintain Good Status, or to move towards Good Status if a waterbody is currently failing its target. Under all conditions, it requires that there should be no deterioration in status. The WFD assessment will, therefore, consider whether there is potential for the proposed Project to cause deterioration in the status of river, lake, transitional, coastal and groundwater bodies in the Study Area.

In order to inform the EIA baseline and WFD assessment, data gathering will focus on a review of potential impacts in terms of the WFD, considering morphological, ecological and chemical aspects of onshore water receptors and coastal receptors within 1 nm of the baseline. The potential requirement for a WFD Compliance Assessment under the WFD will also be reviewed.

A WFD Compliance Assessment would comprise of up to 3 stages; the outcome at each stage determined whether the subsequent stage will be required. The stages are:

- Screening – excludes any activities that do not need to go through the scoping or impact assessment stages;
- Scoping – identifies the receptors that are potentially at risk from the proposed activity and need impact assessment; and
- Impact assessment – considers the potential impacts of the proposed activity, identifies ways to avoid or minimise impacts, and shows if the proposed activity may cause deterioration or jeopardise the water body achieving good status.

The WFD assessment will consider all operations performed as part of the project; and the water body the activity will occur in and all water bodies that could be affected. If any specific activities are identified that have the potential to cause a non-temporary deterioration within a WFD water body that cannot be mitigated, derogation under Article 4(7) will need to be sought, for which NRW is the Appropriate Agency. If the WFD assessment identifies any potential instances of this, then these will be immediately raised with NRW for discussion. The Project team will look to engage with NRW advisory and JNCC at an early stage for discussions on potential requirements for project-specific surveys to inform the WFD assessment.

Table 5.10 - Key Sensitivities and Potential Impacts in relation to the Water Framework Directive

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped in/Out
WFD Designated Water Bodies	There is the potential that sediments could be suspended into the water column during construction and decommissioning (installation of cables and during landfall activities).	Construction Decommissioning	Yes	Increased suspended sediments, sufficient to lead to deterioration in status is very unlikely in the tidal coastal area. If an increase in suspended sediments does occur, this will be temporary in nature and will be rapidly dispersed due to tidal flows. Increased sediment supply as a result of onshore activities could potentially result in localised increases in turbidity in river, lake, and groundwater water bodies.
WFD Designated Water Bodies	There is the potential that contaminated sediments could be suspended into the water column during construction and decommissioning, and contaminants adsorbed onto particles could be released to designated water bodies.	Construction Decommissioning	Yes	Activities associated with construction and decommissioning works are associated with potential for accidental mobilisation of contaminants in the sediment which could directly enter surface water bodies or enter groundwater.
WFD Designated Water Bodies	Accidental release of contaminants from vessels and plant.	Construction Decommissioning	Yes	Activities associated with construction and decommissioning works have the potential for accidental release of contaminants which could directly enter surface water bodies or enter the groundwater.
WFD Designated Water Bodies	Installation of permanent project infrastructure (cable protection) within boundary of WFD water body.	Operational	Yes	The potential impacts caused by rock armour protection are essentially permanent impacts and if they are located in a WFD water body, they will directly impact on the waterbody hydromorphology and biological elements and have the potential to affect waterbody status.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped in/Out
Migratory fish	There is potential for electromagnetic fields (EMF) and thermal effects from transmission assets to have influence the behaviour of migratory fish travelling to/from WFD rivers and transitional water bodies.	Operational	Yes	EMF emissions and thermal increase may arise in the immediate area around Project transmission assets. However, where they occur these changes are only discernible within the immediate vicinity of the transmission infrastructure. The extent affected will constitute a very small proportion of the total habitat available, therefore it is unlikely that this will result in a significant effect.

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6 Biological Environment and Nature Conservation

6.1 Nature Conservation and Designated Sites

6.1.1 Study Area

Differing scales of Study Area have been used depending on the type and nature of the designated sites presented in this Section (Table 6.1).

For EU designated sites, including Special Protection Areas (SPAs), Special Areas of Conservation (SACs), and any Sites of Community Importance (SCIs), all sites within the defined Study Area have been identified and scoped in at the time of writing. This represents a precautionary approach at this time. A Habitats Regulations Assessment (HRA) will be undertaken separately to any EIA and, as part of the HRA process, a formal HRA screening exercise will be undertaken – see Section 3.13. The Stage 1 HRA screening exercise outputs will provide the evidence base to determine which EU designated sites will be subject to the Stage 2 Appropriate Assessment (AA) (see Section 3.13). This will be presented to NRW at a later date for consideration and agreement (i.e. post this EIA Scoping Report).

For non-EU sites, including Sites of Special Scientific Interest (SSSIs) and Marine Conservation Zones (MCZs), some sites within the defined Study Area (up to 100 km from Project area) have been scoped out at this stage; due to no predicted spatial overlap / pathway for impacts with the interest features of these sites.

The proposed Project falls within Pembrokeshire Coast National Park, with much of the coast designated as SSSI or SACs. The Pembrokeshire Coast National Park itself has not been included within this section, but the relevant designations within this area have been included.

Table 6.1 - Designated Sites Study Area Definition and Rationale

Designated Site Type	Study Area	Rationale
Terrestrial designated sites that overlap and are in close proximity to proposed onshore works.	Entire Castlemartin Peninsula, covering all potential landfall options, onshore cable routes and onshore substation location.	Ensures that all terrestrial designated sites, including those that may not overlap with proposed onshore Project infrastructure, are considered within the EIA / HRA. Inclusion of wider area also enables potential mobile components of terrestrial sites (bats) to be fully considered.
Marine / Coastal designated sites that overlap with or are in close proximity to proposed offshore works.	Offshore export cable corridor and offshore array area (plus 10 km buffer for physical marine processes).	Ensures that all marine designated sites, including those that may not directly overlap with any actual offshore project infrastructure, are considered within the EIA / HRA. Inclusion of a wider area also enables assessment of potential impacts on designated sites via sediment plumes / change in

Designated Site Type	Study Area	Rationale
		hydrodynamic regime.
Marine / Coastal designated sites that contain mobile interest / qualifying features (migratory fish; birds; marine mammals).	Accepted foraging ranges or regional sea study areas.	Ensures that EIA / HRA takes full account of: (a) typical foraging ranges by birds that are part of designated site (SPA) populations or designated marine mammals populations of SACs, SCIs or Ramsar sites; (b) movement of migratory birds through the offshore array area and (c) the movement of migratory fish that may pass through the site to SAC rivers and those migrating to marine SACs. Inclusion of classified SPA seabird populations was based on foraging ranges determined as mean maximum foraging range +1 standard deviation (where applicable) as reported by Woodward *et al.* (2019). For marine mammals, all sites within the relevant marine mammal management unit are taken forward for assessment. Assessment of migratory fish is on a regional sea scale, including all SACs situated within, or discharging into the Celtic or Irish seas.

6.1.2 Baseline Data

The following key sources of information have been used to identify designated sites in and around the proposed Project:

- MAGIC online geographical information system (MAGIC, 2020);
- Lle - Welsh Marine Planning Portal (Welsh Government, 2019);
- Wildlife Trust of South and West Wales website;
- Royal Society for the Protection of Birds (RSPB) website;
- Natura 2000 standard data forms published by the Joint Nature Conservation Committee (JNCC); and
- Site Management Plans published by Natural Resources Wales (NRW).

6.1.3 Baseline Environment

The following section provides details of designated sites that have the potential to be impacted by the proposed Project. The sites are presented in line with the categories of designated sites set out in Table 6.1.

6.1.3.1 *Terrestrial Designated Sites*

Table 6.2 lists the designated sites for the terrestrial study area in close proximity to proposed onshore works within the Castlemartin Peninsula.

Table 6.2 - Terrestrial Designated Sites that Overlap with or are in Close Proximity to Proposed Onshore Works

Site Code	Name	Location	Reason for Consideration
Special Area of Conservation (SAC)			
UK0014793	Pembrokeshire Bat Sites and Bosherston Lakes SAC	Overlaps with the Study Area (possible cable route); approx. 48 km from offshore array.	Within the Study Area, noted for inland water bodies, greater and lesser horseshoe bats and otter.
UK0014787	Limestone Coast of South West Wales SAC	Overlaps with the Study Area (possible cable route); approx. 41 km from offshore array.	Within the Study Area, noted for cliffs and caves, cliff top heath, grassland and dunes and associated plant species and greater horseshoe bat.
Special Protection Area (SPA)			
UK9014061	Castlemartin Coast SPA	Overlaps with the Study Area (possible cable route); approx. 42 km from offshore array.	Within the Study Area, noted for breeding coastal birds (chough).
Site of Special Scientific Interest (SSSI)			
SSSI_923 (32WWH)	Angle Peninsula Coast SSSI	Overlaps with the Study Area (possible cable route); approx. 39 km from offshore array.	Within the Study Area, noted for geology, coastal habitats, fish spawning and chough and peregrine falcon presence.
SSSI_1136 (32WVY)	Broomhill Burrows SSSI	Overlaps with the Study Area (possible cable route); approx. 42 km from offshore array.	Within the Study Area, noted for geology, the dune habitats and species, and breeding chough.
SSSI_242 (32WFD)	Castlemartin Corse SSSI	Overlaps with the Study Area (possible cable route); approx. 43 km from offshore array.	Within the Study Area, noted for swamp and fen habitats and species.
Code not known	Castlemartin Cliffs and Dunes SSSI	Overlaps with the Study Area (possible cable route); approx. 43 km from offshore array.	Within the Study Area, noted maritime grassland fronting maritime heath and gorse scrub, chough, sand dune habitats and strand-line beetle.
SSSI_140 (32WQ3)	Castlemartin Range SSSI	Overlaps with the Study Area (possible cable route); approx. 41 km from offshore array.	Within the Study Area, noted for geology and coastal, cliff, maritime grassland and heath habitats and species.

Site Code	Name	Location	Reason for Consideration
SSSI_1379 (32WUS)	Freshwater East Cliffs to Skrinkle Haven SSSI	Overlaps with the Study Area (possible cable route); approx. 54 km from offshore array.	Within the Study Area, noted for coastal habitats and species.
Code not known	Gweunydd Somerton Meadows SSSI	Overlaps with the Study Area (possible cable route).	Within Study Area, noted for grassland fungi.
SSSI_2549 (32WKQ)	Orielton Stable Block and Cellars SSSI	Overlaps with the Study Area (possible cable route); approx. 49 km from offshore array	Within the Study Area, noted for greater and lesser horseshoe bats and other bat species.
SSSI_24 (32WQ4)	Stackpole SSSI	Overlaps with the Study Area (possible cable route); approx. 44 km from offshore array.	Within the Study Area, noted for coastal habitats and species, freshwater habitats and species, greater and lesser horseshoe bats and otter.
SSSI_113 (32WQ5)	Stackpole Quay to Trewent Point SSSI	Overlaps with the Study Area (possible cable route); approx. 49 km from offshore array.	Within the Study Area, noted geology and coastal and cliff habitats and species (linked to SAC / SPA).
SSSI_615 (32WEX)	Stackpole Courtyard Flats and Walled Garden SSSI	Overlaps with the Study Area (possible cable route); approx. 48 km from offshore array.	Within the Study Area, noted breeding horseshoe bats (linked to SAC).
Code not known	St Margaret's Island SSSI	Adjacent to the Study Area; approx. 64 km from offshore array.	Adjacent to the Study Area, noted guillemot, razorbill and kittiwake.
SSSI_1440 (32WPU)	Park House Outbuildings, Stackpole SSSI	Overlaps with the Study Area (possible cable route); approx. 50 km from offshore array.	Within the Study Area, noted for breeding horseshoe bats (linked to SAC).
National Nature Reserve (NNR)			
00062	Stackpole NNR	Overlaps with the Study Area (possible cable route); approx. 49 km from offshore array.	Within the Study Area, noted for geology, landscapes, habitats and species.
Local Nature Reserve (LNR)			
Local Nature Reserve	Freshwater East LNR	Overlaps with the Study Area (possible cable route); approx. 54 km from offshore array.	Within the Study Area, noted for environment.

6.1.3.2 *Marine and Coastal Designated Sites within Close Proximity to Proposed Offshore Works*

Table 6.3 lists the marine and coastal designated sites that overlap or are within 10 km of the export cable corridor and offshore array area. The location of these sites relative to the proposed works is shown in Figure 6.1.

Table 6.3 - Marine / Coastal Designated Sites that Overlap with or are in Close Proximity to Proposed Offshore Works

Site Code	Name	Location	Reason for Consideration
Special Area of Conservation (SAC)			
UK0014787	Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for cliffs and caves, cliff top heath, grassland and dunes and associated plant species and greater horseshoe bat.
UK0013116	Pembrokeshire Marine/ Sir Benfro Forol	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for marine and coastal habitats, marine mammals (grey seal), migratory fish and otter.
UK0030397	West Wales Marine / Gorllewin Cymru Forol	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for marine mammals (harbour porpoise).
UK0030396	Bristol Channel Approaches / Dynesfeydd Môr Hafren	Overlaps with the Study Area	Within the Study Area, noted for marine mammals (harbour porpoise). Within Marine Mammal Management Unit
UK0030398	North Anglesey Marine	Overlaps with the Study Area	Within the Study Area, noted for marine mammals (harbour porpoise). Within Marine Mammal Management Unit
UK0013117	Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau	Overlaps with the Study Area	Within the Study Area, noted for marine mammals (Bottlenose dolphin and Grey seal). Within Marine Mammal Management Unit
Special Protection Area (SPA)			
UK9014051	Skomer, Skokholm and the Seas off Pembrokeshire /	Overlaps with the Study Area	Within the Study Area, with noted breeding seabirds

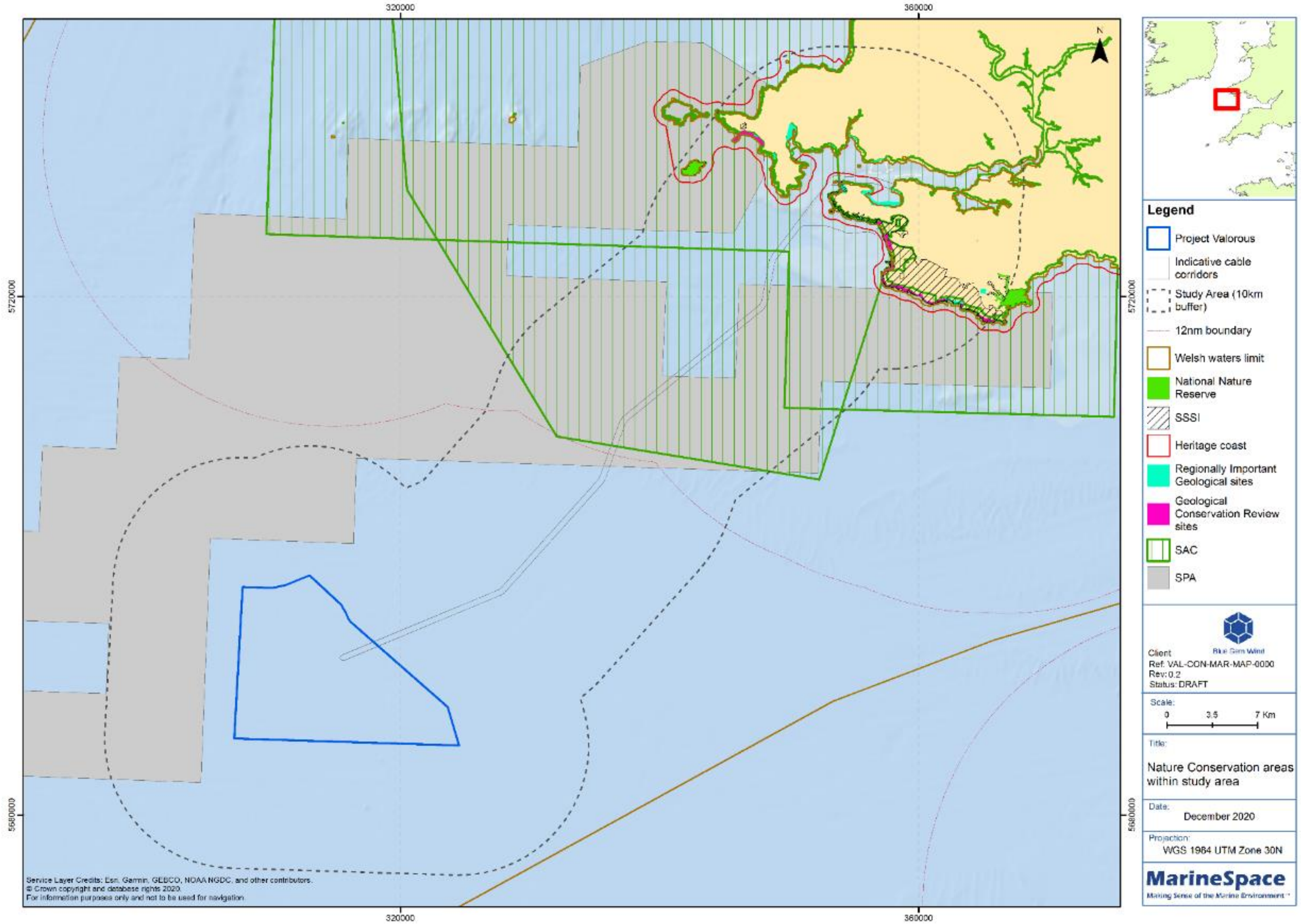
Site Code	Name	Location	Reason for Consideration
	Sgomer, Sgogwm a Moroedd Penfro		and coastal birds (including, puffins and chough).
National Nature Reserve (NNR)			
62	Stackpole	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for geology, coastal habitats and species, marine mammals (grey seal), seabirds and chough.
112	Skokholm	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for geology, coastal habitats and species, marine mammals (grey seal), seabirds and chough.
Site of Special Scientific Interest (SSSI)			
923	Arfordir Penrhyn Angle / Angle Peninsula Coast	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for breeding seabirds, breeding chough and intertidal rocky shore communities.
140	Castlemartin Range	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for rocky shore communities, sand dunes, wetland habitats, breeding seabirds, and marine mammals (grey seal).
297	Skokholm	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for breeding seabirds, breeding chough and marine mammals (grey seal).
24	Stackpole	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for breeding seabirds, breeding chough and marine mammals (grey seal).
585	Dale and South Marloes Coast	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for breeding chough and intertidal rocky shore communities.
342	De Porth Sain Ffraid / St Bride's Bay South	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for rocky shore communities, geological features and marine mammals (grey seal).

Site Code	Name	Location	Reason for Consideration
282	Milford Haven Waterway	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for rocky shore communities, saltmarsh, swamp, saline lagoons and nationally important numbers of migratory waterfowl.
Heritage Coast			
Laterally	Marloes and Dale	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for landscapes.
Laterally	South Pembrokeshire	Overlaps with the Study Area (possible cable route).	Within the Study Area, noted for geology, coastal habitats, landscapes and land use.

6.1.3.3 Marine and Coastal Designated Sites that Contain Mobile and Qualifying Features

Appendix B provides details of the marine and coastal designated sites which contain mobile interest/qualifying features (marine mammals, birds, fish) that are located within the relevant foraging ranges or regional sea study areas (as identified in Table 6.1).

Figure 6.1 - Location of Designated Sites within 10 km of the Proposed Array Site and/or Cable Route



6.1.4 Identification of Key Sensitivities and Potential Impacts

For each type of site identified in Section 6.1, an assessment of potential impacts arising from changes in the environment and the effects as a consequence. As detailed in the introductory section, a separate HRA screening exercise will be undertaken post-scoping which will list all EU designated sites that will be subject to AA

6.1.5 Potential Mitigation

Potential effects to, and proposed mitigation measures for species and habitats of nature conservation significance will be addressed in Section 6.2 (Benthic Subtidal and Intertidal Ecology), Section 6.3 (Fish and Shellfish Ecology), Section 6.4 (Marine Mammals and Reptiles Ecology), Section 6.5 (Ornithology) and Section 6.6 (Terrestrial Ecology).

Mitigation will take place in the hierarchy set out in Section 3.9.

6.1.6 Proposed Approach to Environmental Assessment

The EIA approach for species and habitats of nature conservation significance will be addressed in Section 6.2 (Benthic Subtidal and Intertidal Ecology), Section 6.3 (Fish and Shellfish Ecology), Section 6.4 (Marine Mammals and Reptiles Ecology), Section 6.5 (Ornithology) and Section **Error! Reference source not found.** (Terrestrial Ecology). Data from these chapters and relevant sources, including local regulators, will be used to assess the effects of the proposed Project on designated and protected sites.

EU designated sites (SAC / SPA) will be subject to the HRA process. Details of the proposed approach to HRA are provided in Appendix A.

BGW will liaise with statutory authorities throughout the EIA process, to ensure project survey designs are robust and sufficient to assess potential impacts to designated sites, species and habitats

Table 6.4 - Key Sensitivities and Potential Impacts to Designated Sites within the Terrestrial Study Area

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Special Areas of Conservation				
Pembrokeshire Bat Sites and Bosherston Lakes Limestone Coast South West Wales	Installation / removal of infrastructure, associated construction activities and operation of the substation has the potential to cause disturbance through noise, vibration and lighting, severance and loss of foraging habitat and commuting corridors.	Construction Operational Decommissioning	Yes	Dependent on final onshore infrastructure locations/ layouts; Potential damage and loss of habitats; Reduction in foraging success; Behavioral changes and injury to individuals and potential stress to protected species (bats).
Special Protection Areas				
Castlemartin Coast	Installation, maintenance and removal of infrastructure and construction has the potential to disturb breeding habitat and result in the loss of foraging habitats.	Construction Operation Decommissioning	Yes	Reduction in foraging success; Behavioral changes and injury to individuals and potential stress to protected species (birds).

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Sites of Specific Scientific Interest				
Angle Peninsula Coast Broomhill Burrows Castlemartin Corse Castlemartin Cliffs and Dunes Castlemartin Range Freshwater East Cliffs to Skrinkle Haven Gweunydd Somerton Meadows Orielton Stable Block and Cellars Stackpole Stackpole Quay to Trewent Point Stackpole Courtyard Flats and Walled Garden Park House Outbuildings, Stackpole	Installation / removal of infrastructure, associated construction activities and operation of the substation has the potential to cause direct habitat loss and disturbance through noise, vibration and lighting, severance and loss of foraging habitat, and commuting corridors.	Construction Operational Decommissioning	Yes	Potential damage and loss of habitats; Reduction in foraging success (bats, fish and birds); Behavioral changes and injury to individuals and potential stress to protected species (bats, fish, birds, otters).
National Nature Reserves				

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Stackpole	Installation / removal of infrastructure and associated construction activities have the potential to cause disturbance to species and habitats, loss of habitat and severance of connectivity.	Construction Decommissioning	Yes	Potential damage and loss of habitats; Reduction in foraging success; Behavioral changes and injury to individuals and potential stress to protected species (bats).
Local Nature Reserves				
Freshwater East	Installation / removal of infrastructure and associated construction activities has the potential to cause noise disturbance and loss of habitat.	Construction Decommissioning	Yes	Potential damage and loss of habitats.

Table 6.5 - Key Sensitivities and Potential Impacts to Designated Sites within the Marine and Coastal Study Area

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in) [10]	Rationale for Impact Scoped In/Out
Special Protection Areas				
Skomer, Skokholm and the Seas off Pembrokeshire Full list of SPAs provided in Appendix B	Surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect). Potential disturbance and risk of pollution incidences impacting habitats and species near export cable landfall.	Construction Operational Decommissioning	Yes	Potential damage and loss of habitats and features; Potential mortality of key species due to collision risk; Create alteration in migratory routes; Reduction in foraging success; Behavioural changes and injury to individuals and potential stress to protected species (birds).
Special Areas of Conservation				
West Wales Marine Pembrokeshire Marine Limestone Coast of South West Wales North Anglesey Marine	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey	Construction Operational Decommissioning	Yes	Potential damage and loss of habitats and features. Create alteration in migratory routes; Reduction in foraging success

[10] Future HRA screening exercise will provide definitive basis for inclusion/further assessment of SACs/SPAs in EIA/HRA

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in) [10]	Rationale for Impact Scoped In/Out
Pen Llyn a`r Sarnau Full list of SACs provided in Appendix B	availability. Potential disturbance and risk of pollution incidences impacting habitats and species near export cable landfall. Mooring lines and cabling between the platform and the anchors used during the project could pose an entanglement risk to marine mammals.			(bats, fish and birds); Behavioural changes and injury to individuals and potential stress to protected species (bats, fish, birds, otters and marine mammals (grey seals and harbour porpoise)). There is a risk that marine mammals using the area may get tangled in mooring lines. The mooring lines may also become entangled with derelict fishing gear, which may further increase the chance of entanglement, though the likelihood of this is poorly understood.
Sites of Specific Scientific Interest				
Arfordir Penrhyn Angle / Angle Peninsula Coast Castlemartin Range Skokholm Stackpole Dale and South Marloes Coast De Porth Sain Ffraid / St Bride's Bay South	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect). Potential disturbance and risk of pollution incidences	Construction Operational Decommissioning	Yes	Potential damage and loss of habitats and features; Reduction in recruitment and spawning success; Create alteration in migratory routes; Reduction in foraging success (fish and birds); Behavioural changes and injury

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in) [10]	Rationale for Impact Scoped In/Out
Milford Haven Waterway	impacting habitats and species near export cable landfall.			to individuals and potential stress to protected species (fish, birds, otters and marine mammals (grey seals)).
National Nature Reserves				
Skokholm Stackpole	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect). Potential disturbance to habitats and species near export cable landfall.	Construction Operational Decommissioning	Yes	Potential damage and loss of habitats; Create alteration in migratory routes; Reduction in foraging success (fish and birds); Potential collision risk; Behavioural changes and injury to individuals and potential stress to protected species (birds and marine mammals (grey seals)).
Heritage Coast				
South Pembrokeshire Marloes and Dale	Installation and removal of infrastructure directly impacting features	Construction Operational Decommissioning	Yes	Potential damage and loss of features.

Table 6.6 - Key Sensitivities and Potential Impacts to Designated Sites that Contain Mobile or Qualifying Features within the Marine and Coastal Study Area (100 km)

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in) [11]	Rational for impact scoped in/out
Special Protection Areas				
Full list of SPAs provided in Appendix B	Installation and removal of surface and subsea infrastructure has the potential to cause noise disturbance with additional effects from collision hazards, and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect). Potential disturbance and risk of pollution incidences impacting habitats and species near export cable landfall.	Construction Operational Decommissioning	Yes	Create alteration in migratory routes; Reduction in foraging success; Behavioural changes and injury to individuals and potential stress to protected species (birds).

[11] Future HRA screening exercise will provide definitive basis for inclusion/further assessment of SACs/SPAs in EIA/HRA

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in) [11]	Rational for impact scoped in/out
Special Areas of Conservation				
Full list of SACs provided in Appendix B	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance (including UXO clearance) and loss of habitat leading to reduced prey availability and impacts to foraging animals (indirect). Potential disturbance to habitats and species near export cable landfall.	Construction Operational Decommissioning	Yes	Create alteration in migratory routes; Reduction in foraging success; Behavioural changes and injury to individuals and potential stress to protected species (fish, birds and marine mammals (grey seals, bottlenose dolphin and harbour porpoise)).
Ramsar				
Burry Inlet Les Pierres de Lecq (the Paternosters) Jersey Les Écréhous & Les Dirouilles, Jersey Baie du Mont Saint-	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance (including UXO clearance) and loss	Construction Decommissioning	Yes	Reduction in foraging success; Behavioural changes and injury to individuals and potential stress to protected marine

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in) [11]	Rational for impact scoped in/out
Michel South East Coast of Jersey, Channel Islands Les Minquiers, Jersey Baie de Seine orientale Baie de Somme	of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect).			mammal species.

6.2 Benthic Subtidal and Intertidal Ecology

6.2.1 Study Area

The Study Area covers all areas currently under consideration for placement of marine project infrastructure, including the offshore array area, an offshore substation, potential marine export cable corridor and landfall options (see Figure 6.2). The Study Area encompasses water depths of 0-84 m.

The proposed offshore array area (turbines, anchors and moorings) will cover a seabed area of between approximately 35 km^2 and 72 km^2, depending on the final design and turbine size. Up to 31 wind turbines with a catenary mooring system are proposed. The offshore substation is likely be located within the eastern area of the offshore array area and connect to the turbines via a dynamic inter-array cabling system.

The marine export cable will be comprised of up to 2 cables sited within trenches (subject to ground conditions), protected by scour control systems and cable protection in exposed areas of the seabed. The potential landfall options include West Angle Bay, Angle Bay (Sawdern Point) Freshwater West beach and Angle Peninsula South Coast. For full details of the project description see Section 4.

6.2.2 Baseline Data

This report has been informed using the available baseline data for the area. No project-specific surveys have been undertaken to date to inform this report.

Key documents consulted in compiling this Section comprise:

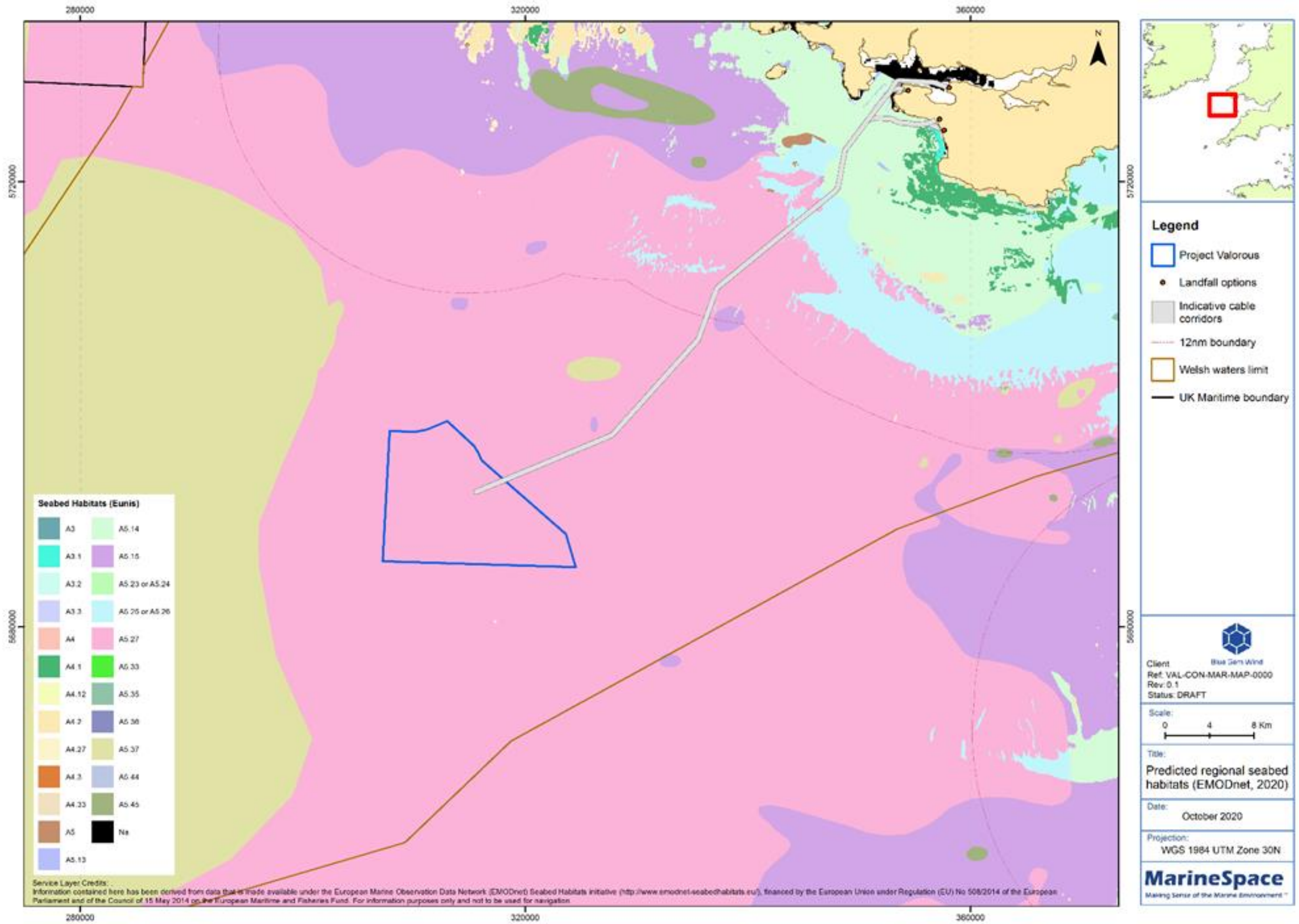
- Marine Information Network (MarLIN);
- Lle -Marine Planning Portal for Wales (Welsh Government, 2020);
- National Biodiversity Network (NBN) Gateway;
- The European Marine Observation and Data Network (EMODnet, 2020);
- European Nature Information System (EUNIS) (European Environment Agency (EAA, 2020));
- Greenlink Interconnector Marine Environmental Statement – Wales (Greenlink Interconnector Ltd, 2019);
- Pembrokeshire Demonstration Zone EIA Scoping Report (Wave Hub, 2018); and
- Erebus EIA Scoping Report (MarineSpace Ltd, 2019).

6.2.3 Existing Baseline

The waters off Pembrokeshire support a diverse range of intertidal and subtidal habitats. The broadscale predictive habitat data as part of EUSeaMap (2020) are available on EMODnet (2020) and have been displayed for the Study Area in Figure 6.2. Based on the data presented on EMODnet and also Lle, the marine Study Area comprises a highly varied nearshore environment and a more uniform offshore environment within which the offshore array area lies.

The offshore array area is located wholly within an area of EUNIS habitat A5.27 Deep circalittoral sand. Areas of A5.37 Deep circalittoral mud and discrete areas of A5.15 Deep circalittoral coarse sediment are also nearby. These are outside of the offshore array area itself, but may potentially overlap in limited locations with the indicative offshore export cable corridor. Within the inshore subtidal areas of the Study Area, a band of Circalittoral fine, or muddy sand (A5.25 or A5.26, respectively) borders a wider shallower area of Infralittoral fine or muddy sand (A5.23 or A5.24, respectively) (Figure 6.2). It may be expected that these areas will overlap or be adjacent to the inshore export cable corridor. Summary Descriptions of the broad-scale subtidal EUNIS habitats of the offshore array area and export cable corridor are summarised in Table 6.7.

Figure 6.2 - Marine Habitats in the Study Area (Source: EUSeaMap (2020). Data Available on EMODnet (2020).



Most of the coastline in the Study Area comprises intertidal sand with moderate-high energy intertidal rocks, with known biogenic habitats (e.g. seagrass beds and saltmarsh) in only a few sheltered locations in Milford Haven, such as around Dale, Angle Bay and West Angle Bay.

Potential landfall options include Angle Bay (Sawdern Point), West Angle Bay, Freshwater West Bay and Angle Peninsula South Coast. West Angle Bay and Angle Bay (Sawdern Point) are located near the mouth of Milford Haven estuary, on the south side of the waterway. The bay consists of high energy circalittoral and infralittoral seabed, and low energy circalittoral seabed. The more, deeper areas comprise of A5.14 Circalittoral coarse sediment, with small patches of A5.13 Infralittoral coarse sediment (not shown on Figure 6.4).

Freshwater West is located on the southwest Pembrokeshire coastline and forms part of the Castlemartin Ranges. The seabed here is characterised as A3.1 Atlantic and Mediterranean high energy infralittoral rock in the nearshore and at Freshwater West itself, there is also present, areas of A5.13 Infralittoral coarse sediment. In the deeper coastal waters off the Castlemartin Ranges, Atlantic and Mediterranean Moderate energy circalittoral rock (A4.1) is present (Figure 6.2).

Summary descriptions of the subtidal and intertidal broadscale EUNIS habitats present within the export cable corridor and potential landfall locations are listed in Table 6.7.

Table 6.7 - EUNIS Habitats in the Benthic Study Area (Summarised From: EEA, 2020)

EUNIS Habitat types	Summary Description
Subtidal Offshore	
A5.15 Deep circalittoral coarse sand	Offshore (deep) circalittoral habitats with coarse sands and gravel or shell. Such habitats are quite diverse compared to shallower versions of this habitat and generally characterised by robust infaunal polychaete and bivalve species. In some areas, settlement of *Modiolus modiolus* larvae may occur and thus these habitats may occasionally have large numbers of juvenile *M. Modiolus*. Areas where they reach maturity their byssus threads bind the sediment, increasing stability and allowing an increased deposition of silt leading to the development of the biotope A5.622.
A5.27 Deep circalittoral sand	Offshore (deep) circalittoral habitats with fine sands or non-cohesive muddy sands. Very little data are available, however they are likely to be more stable than their shallower counterparts and are characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms
A5.37 Deep circalittoral mud	Offshore (deep) circlalittoral habitats with mud and cohesive sandy mud, typically <50-70 m depth. A variety of faunal communities may develop, depending upon the level of silt / clay and organic matter in the sediment. Communities typically dominated by polychaetes but often with high numbers of bivalves such as *Thyasira* spp., echinoderms and foraminifera.
Subtidal Nearshore	
A4.1 Atlantic and Mediterranean high energy circalittoral rock	Occurs on extremely wave-exposed to exposed circalittoral bedrock and boulders subject to tidal streams ranging from strong to very strong. Typically found in tidal straits and narrows. The high energy levels found within this habitat complex are reflected in the fauna recorded. Characteristic of this habitat complex is the dense 'carpet' of the hydroid *Tubularia indivisa* and *Balanus crenatus. Alcyonium digitatum* and sponges may also be recorded
A5.14 Circalittoral coarse sediment	Tide-swept circalittoral coarse sands, gravel and shingle generally in depths of over 15-20 m. Habitat may be found in tidal channels of marine inlets, along exposed coasts and offshore. This habitat, as with shallower coarse sediments, may be characterised by robust infaunal polychaetes, mobile crustacea and bivalves.

EUNIS Habitat types	Summary Description
A5.23 Infralittoral fine sand	Clean sands which occur in shallow water, either on the open coast or in tide-swept channels of marine inlets. Habitat typically lacks a significant seaweed component and is characterised by robust fauna, particularly amphipods and robust polychaetes
A5.24 Infralittoral muddy sand	Non-cohesive muddy sand (5-20% silt/clay) in the infralittoral zone, extending from the extreme lower shore down to more stable circalittoral zone at about 15-20m. The habitat supports a variety of animal-dominated communities, particularly polychaetes, bivalves, and the urchin *Echinocardium cordatum*.
A5.25 Circalittoral fine sand	Clean fine sands, < 5% silt/clay, in deeper water, either on the open coast or in tide-swept channels of marine inlets in depths of over 15-20 m. Habitat may also extend offshore and is characterised by a wide range of echinoderms, polychaetes and bivalves. This habitat is generally more stable than shallower, infralittoral sands and consequently supports a more diverse community.
A5.26 Circalittoral muddy sand	Circalittoral non-cohesive muddy sands with the silt content typically ranging from 5-20%. This habitat is generally found in water depths >15-20 m and supports animal-dominated communities characterised by a wide variety of polychaetes, bivalves, and echinoderms. These circalittoral habitats tend to be more stable than their infralittoral counterparts and as such support a richer infaunal community.
Intertidal	
A3.1 Atlantic and Mediterranean high energy infralittoral rock	Rocky habitats in the infralittoral zone subject to exposed to extremely exposed wave action or strong tidal streams. Typically supports a community of kelp *Laminaria hyperborean* with foliose seaweeds and animals, the latter tending to become more prominent in areas of strongest water movement. The depth to which the kelp extends varies according to water clarity, exceptionally. The sublittoral fringe is characterised by dabberlocks *Malaria esculenta*.
A5.13 Infraittoral coarse sediment	Moderately exposed habitats with coarse sand, gravelly sand, shingle and gravel in the infralittoral. Subject to disturbance by tidal steams and wave action. Such habitats found on the open coast or in tide-swept marine inlets are characterised by a robust fauna of infaunal polychaetes, cumacean crustacea, and venerid bivalves.

Many of these habitats are listed under nature conservation designations, such as Annex I of the EC Habitats Directive, OSPAR List of Threatened and / or Declining Species and Habitats, and Habitats of Principal Importance (as designated under Section 7 of the Environment (Wales) Act (2016)). Annex I habitats are designated features of the Pembrokeshire Marine SAC, which overlaps the Study Area (Figure 6.3). The Annex I habitats in the Study Area include:

- H1130 Estuaries;
- H8330 Submerged or partially submerged marine caves;
- H1170 Reefs (intertidal and subtidal);
- H1160 Large shallow inlets and bays;
- H1140 Mudflats and sandflats not covered by seawater at low tide;
- H1150 Coastal lagoons;
- H1330 Atlantic salt meadows *(Glauco-Puccinellietalia maritimae)*;
- H1110 Sandbanks which are slightly covered by sea water all the time.

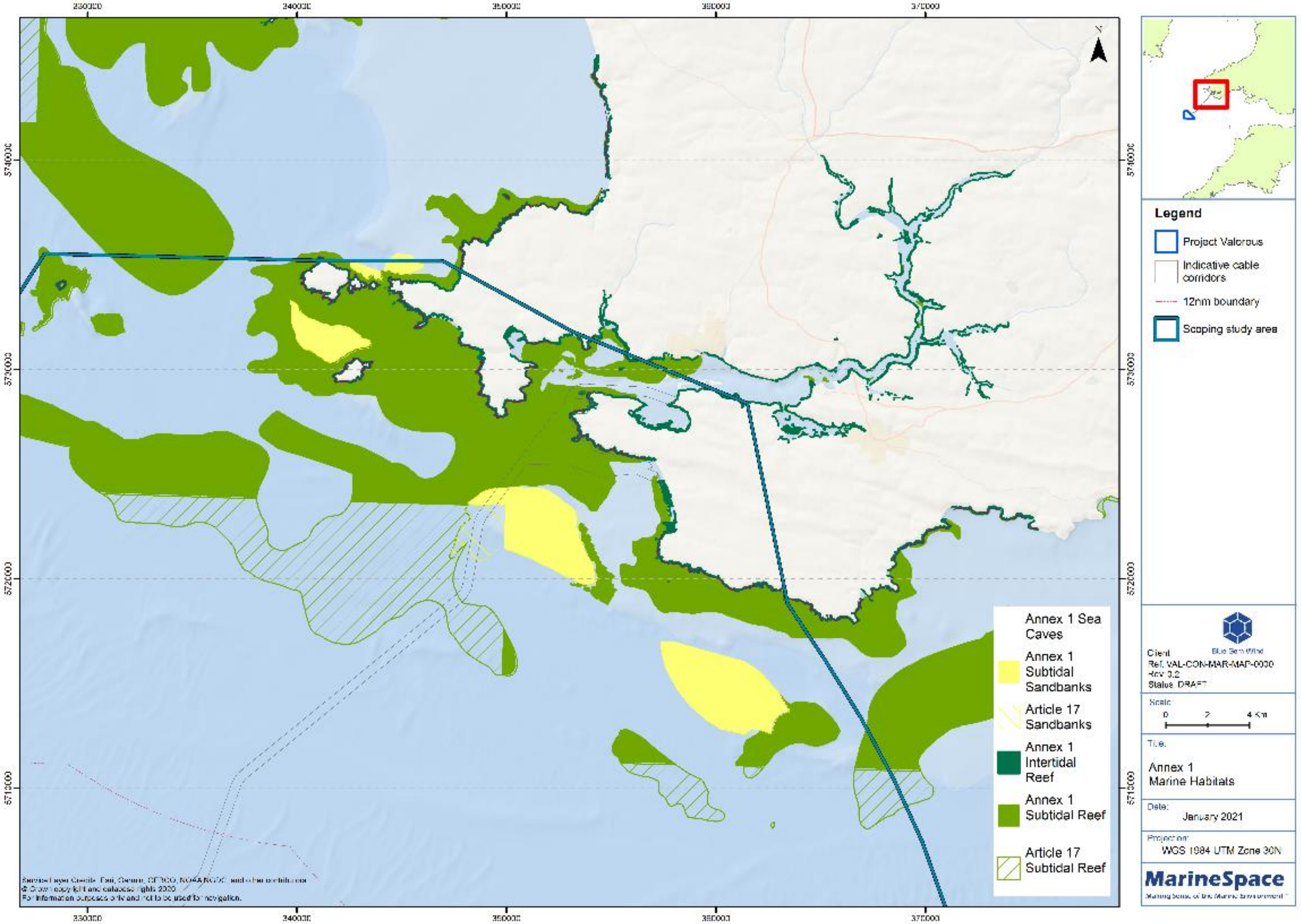
The non-interactive map for Pembrokeshire Marine SAC (NRW, 2016) shows the distribution of the qualifying features, as displayed in Figure 6.3 and with the current known extent of these features, as required to be reported under Article 17 (Lle Portal - Welsh Government, 2020).

There is no indicative spatial overlap between the footprint of the offshore array area, and Annex I features. However, the proposed offshore and inshore export cable corridor may overlap with designated features including reefs (H1170) and subtidal sand banks (H1110).

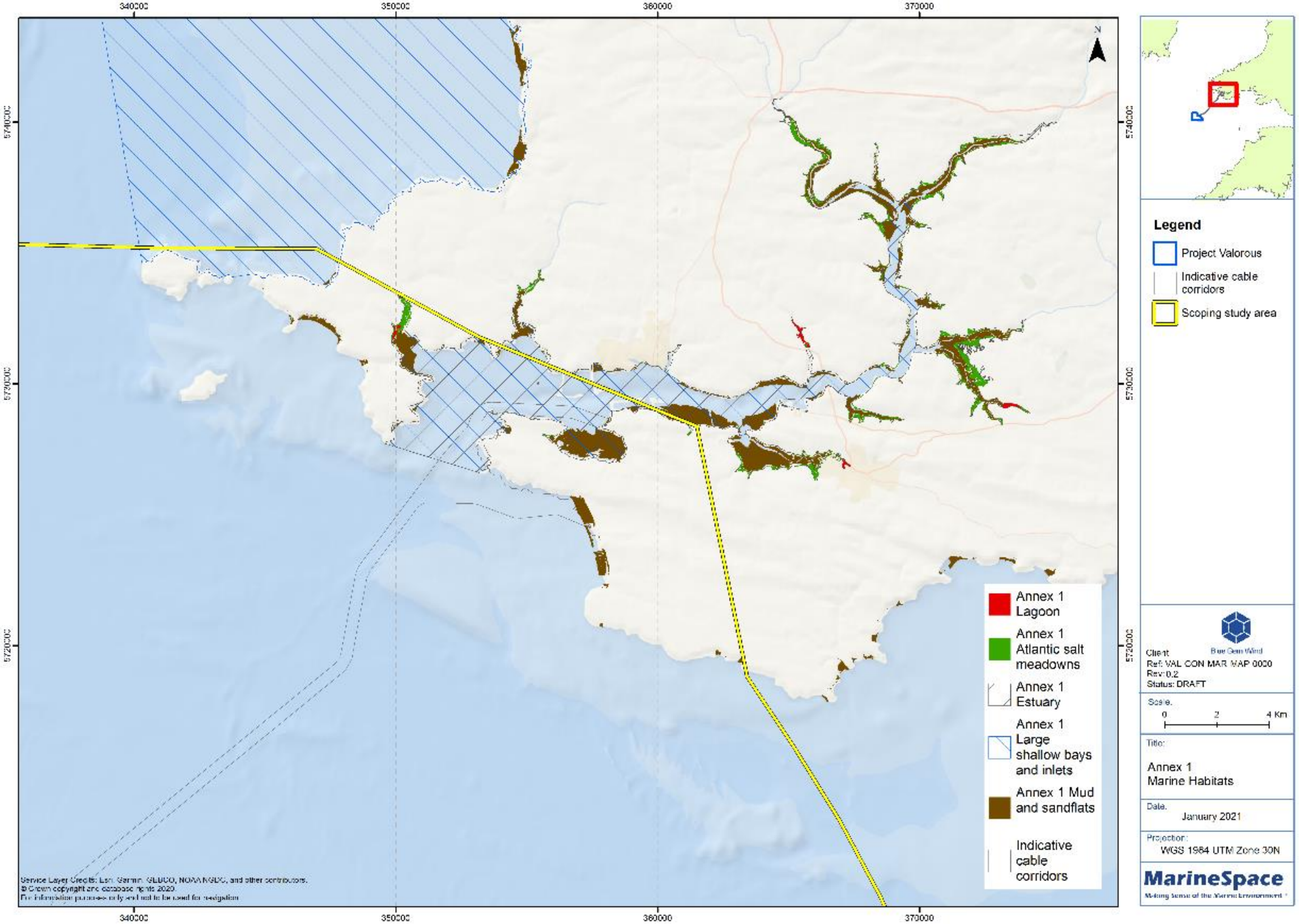
The landfall site options have been assessed for the presence of any designated features. All potential landfall options lie within the Pembrokeshire Marine SAC. Sea caves and areas of Reef overlap Angle Bay (Sawdern Point) and West Angle Bay. Though Freshwater West itself does not contain either of these features at the potential landfall points, the approaches to the landfall do, however, contain Reef features. Consideration within the EIA will be given to potential impacts to sea caves along the Angle Peninsula South Coast between Whitedole Bay and Gravel Bay, should HDD be required. Intertidal mud and sand flats (H1140) are present at Freshwater West, Angle Bay and West Angle Bay and an area of subtidal sandbank feature (H1110) is also located offshore of Freshwater West. West Angle Bay and Angle Bay lie within the designated Large shallow inlets and bays feature (H1160), and a marine inlet (ria) Estuary (H1130). Atlantic salt meadow (H1130) and lagoons (H1150) are not present at any of the potential cable landfall options or inshore export cable corridor (Figure 6.3).

Figure 6.3 - Location of Annex I Features within Pembrokeshire Marine SAC

(a) Sea caves (H8830); Reefs (H1170); and Subtidal sandbank (H1110). Article 17 reported extension of these features shown where appropriate.



(b) Estuaries (H1130); Large shallow inlets and bays (H1160); intertidal mud and sandflats (H1140); Atlantic salt meadows (H1330) and Lagoons (H1150)



The location of Section 7 and OSPAR marine habitats for the Study Area are presented in Figure 6.4 . The Section 7 priority habitat, Estuarine rock may overlap with the potential marine export cable corridor and landfall locations. Section 7 and OSPAR biogenic habitats of maerl beds and saltmarsh are present within Milford Haven, along with underboulder communities; but are remote from potential export cable corridor and landfall locations. Section 7 and OSPAR intertidal mudflats and seagrass bed habitats are present in Angle Bay (Sawdern Point). Areas of the Section 7 mixed muddy sediments habitat (not shown in Figure 6.4), are present across the inshore subtidal areas, and thus may overlap with the potential ECR (Lle Portal – Welsh Government, 2020).

Descriptions of the Annex I, Section 7 and OSPAR designated habitats, and the potential overlap with the Project Infrastructure are detailed in Table 6.8.

Figure 6.4 - Location of Habitats Listed as Habitats of Principal Importance under the Environment (Wales) Act Section 7 and as Threatened and / or Declining under OSPAR in the Vicinity of the Study Area

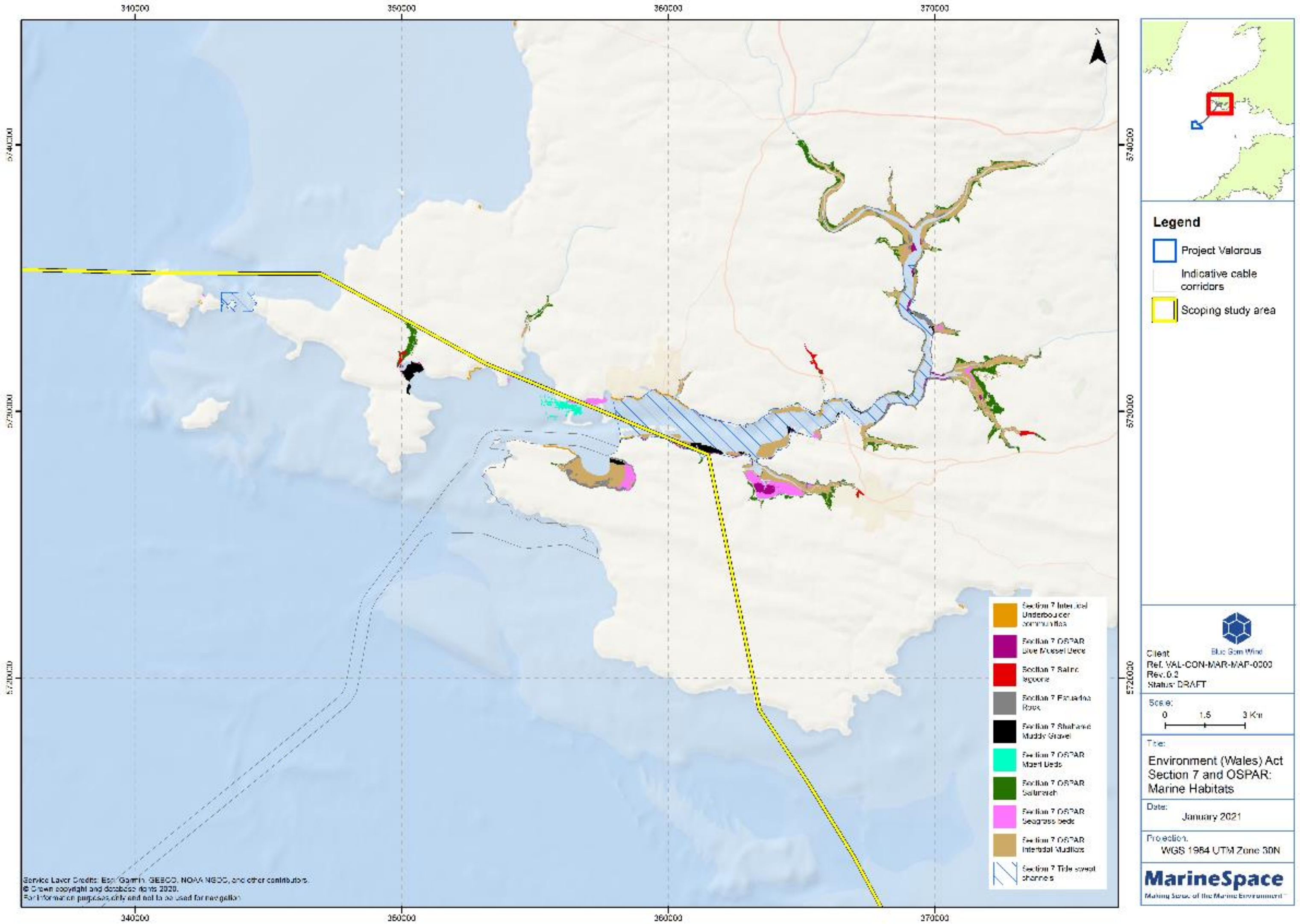


Table 6.8 - Habitat Types, Description and Protection Status in the Benthic Study Area

Habitat types	Description and Potential Project Overlap	Protection Status
Estuaries	River estuaries are coastal inlets where, unlike 'large shallow inlets and bays' there is generally a substantial freshwater influence. The mixing of freshwater and sea water and the reduced current flows in the shelter of the estuary lead to deposition of fine sediments, often forming extensive intertidal sand and mud flats. Where the tidal currents are faster than flood tides, most sediments deposit to form a delta at the mouth of the estuary. Such features occur within the boundary of the benthic Study Area (NRW, 2016). The entrance to Milford Haven is designated as a marine inlet (ria), with the additional designated estuary commencing approximately 2.5 km into the Milford Haven. The proposed Project infrastructure may overlap the marine inlet (ria) designated feature if West Angle Bay or Angle Bay is selected as the cable landfall location.	**Annex I habitat 1130**: Selected primary qualifying feature of: Pembrokeshire Marine SAC. **Section 7:** Estuarine rocky habitats. Tide swept channels Intertidal Under-boulder communities
Large shallow inlets and bays	Large indentations of the coast where, in contrast to estuaries, the influence of freshwater is generally limited. These shallow indentations are generally sheltered from wave action and contain a great diversity of sediments and substrates with a well-developed zonation of benthic communities. These communities have generally a high biodiversity. The limit of shallow water is sometimes defined by the distribution of the seagrass *Zostera* spp. and *Potamegeton* spp. associations. Several physiographic types may be included under this category providing the water is shallow over a major part of the area: *embayments*, *fjards* and *ria* (sub-type voe in Scotland) Such features occur within the boundary of the benthic Study Area. The large shallow inlet habitat extends through the Milford Haven to a boundary line between the 2 headlands at the entrance to the estuary. This designated feature would be overlapped by proposed Project infrastructure should the cable landfall be at West Angle Bay or Angle Bay.	**Annex I habitat 1160**: Selected primary qualifying feature of: Pembrokeshire Marine SAC. **Section 7:** Sheltered muddy gravels **Section 7 and OSPAR List:** Seagrass beds/*Zostera* Beds

Habitat types	Description and Potential Project Overlap	Protection Status
Reefs (intertidal and subtidal)	Submarine, or exposed at low tide, rocky substrates and biogenic concretions, which arise from the sea floor in the sublittoral zone but may extend into the littoral zone where there is an uninterrupted zonation of plant and animal communities. These reefs generally support a zonation of benthic communities of algae and animal species including concretions, encrustations and corallogenic concretions. Such features occur within the boundary of the benthic Study Area. Reefs are widespread throughout the coastal portion of the Study Area. Freshwater West is not predicted to contain reef although there are discrete reef locations offshore of its location that could potentially overlap with cable route, should the landfall option of Freshwater West be selected. There are areas of indicative mapped areas of reef in the inshore area of West Angle Bay.	**Annex I habitat 1170:** Selected primary qualifying feature of: Pembrokeshire Marine SAC. **Section 7 and OSPAR List:** Biogenic reefs of Maerl beds *Sabellaria spinulosa* reef[12] **OSPAR List** Biogenic reefs of *Mytilus edulis* Beds
Submerged or partially submerged caves	Caves situated under the sea or opened to it, at least at high tide, including partially submerged sea caves. The bottom and sides of these caves support communities of marine invertebrates and algae which will vary depending on the degree of water movement and scour in the cave system. Such features occur within the boundary of the benthic Study Area. Sea caves occur specifically around the Angle peninsula, along the Castlemartin Ranges coastline, and along the northern coast of Milford Haven waterway (not including the inner estuary). Proposed Project infrastructure may overlap the indicative location of sea caves if the landfall option of West Angle Bay is selected	**Annex I habitat 8330**: Qualifying feature but not primary reason for selection of: Pembrokeshire Marine SAC
Mudflats and sandflats not covered by seawater at low tide	Intertidal sands and mudflats submerged at high tide and exposed at low tide. Occurring extensively along the open coasts, and lagoon inlets Categorised either as *clean sands, muddy sands* or *mudflats.* They are of particular importance as feeding grounds for wildfowl and waders. Such features occur within the boundary of the benthic Study Area. The proposed Project infrastructure may overlap this designated feature if the cable landfall option of Freshwater West, West Angle Bay or Angle Bay is selected.	**Annex I habitat 1140**: Qualifying feature but not primary reason for selection of: Pembrokeshire Marine SAC. **Section 7 and OSPAR List:** Intertidal mudflats

[12] Section 7 and OSPAR *Sabellaria spinulosa* not confirmed as present (Lle Data Portal - Welsh Government (2020). Feature included here as a precautionary approach, and presence in relation to Project overlap will be confirmed following baseline surveys.

Habitat types	Description and Potential Project Overlap	Protection Status
Coastal lagoons	Lagoons are areas of shallow coastal saltwater, of varying salinity and water volume, wholly or partially separated from the sea by sand banks or shingle, or, less frequently, by rocks. Salinity may vary from brackish water to hypersalinity depending on rainfall, evaporation and through the addition of fresh seawater from storms, temporary flooding of the sea in winter or tidal exchange. Main subtypes: *isolated*, *percolation*, *silled* and *sluiced lagoons,* and *lagoonal inlets.* Limited species present but of those they include important lagoonal specialists. Such features occur within the boundary of the benthic Study Area, specifically at one location at Dale (Pickleridge lagoon), however this feature is not overlapped by the proposed Project infrastructure.	**Annex I habitat 1150:** Qualifying feature but not primary reason for selection of: Pembrokeshire Marine SAC. **Section 7 and OSPAR List:** Saline lagoons .
Atlantic salt meadows *(Glauco-Puccinellietalia maritimae)*	Salt meadows (saltmarshes) of develop when halophytic vegetation colonise sheltered soft intertidal sediments A wide range of community types are represented and can cover a large area. Such features occur within the boundary of the benthic Study Area, although only within Angle Bay in Milford Haven. Therefore, the designated feature would be overlapped if landfall is proposed at Angle Bay.	**Annex I habitat 1330:** Qualifying feature but not primary reason for selection of: Pembrokeshire Marine SAC. **Section 7 and OSPAR List:** Coastal Saltmarsh
Sandbanks which are slightly covered by sea water all the time	Sublittoral sandbanks, permanently submerged. Water depth is seldom more than 20 m below Chart Datum. Diversity and type of communities present dependent on sediment type. Feature sub types: *gravelly and clean sands; muddy sands; eelgrass Zostera marina beds;* and *maerl beds.* Such features occur within the boundary of the benthic Study Area. Within Pembrokeshire Marine SAC there is a designated Annex I subtidal sandbank approximately 4 km off the Castlemartin coast. here is the potential overlap between these protected features and proposed Project infrastructure (specifically the ECR).	**Annex I habitat 1110**: Qualifying feature, but not primary reason for selection of: Pembrokeshire Marine SAC.

6.2.4 Identification of Key Sensitivities and Potential Impacts

Table 6.9 - Key Sensitivities and Potential Impacts to the Benthic Receptors in the Study Area.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Offshore Array - Turbines: installation, maintenance and removal of turbine infrastructure (e.g. anchor mooring) **Protected Subtidal** habitats and associated species (as listed in Table 6.8)	Physical disturbance to protected habitats and species and habitat loss / displacement. The sensitivity of the habitats will depend on the species present, as determined during surveys. Extent of effect will be limited to the Project infrastructure footprint. Habitat loss may be temporary, such as through vessel anchoring, or long term (considered between 15 and 60 years, i.e. for the duration of the Project) if it is due to footprint of infrastructure installation.	Construction Operational Decommissioning	Yes	No piling or drilling to install the turbine infrastructure within the Offshore Array is anticipated at this stage, however, anchor moorings will be an important consideration. The preferred option for the WTGs is the use of catenary moorings with drag anchors. Suction piles and drilled piles will be considered depending on the site-specific ground conditions. Habitat is likely to contain mostly robust fauna that has limited sensitivity, and a wide area of A5.27 is available surrounding the Offshore Array. There are no known Annex I habitats within footprint of the array. However, as the species present are not known, this impact will be taken forward to the EIA.
Inter-Array and Marine Export Cables (ECR) and Landfall: installation, maintenance and removal of infrastructure (cable laying (and protection), Installation of cable landfall) **Protected Subtidal/Intertidal** and associated species (as listed in Table 6.8)		Construction Operational Decommissioning	Yes	Horizontal directional drilling (HDD) may be required at the landfall location. It may be necessary for temporary cofferdam installation at the planned HDD exit point. The inshore subtidal and intertidal areas have known Annex I habitats and features that are designated as part of the Pembrokeshire Marine SAC, such as sea caves, subtidal sandbanks, mudflats and sandflats, and reefs. These may be highly localised and support significant biodiversity. This impact will be assessed under the EIA. Mitigation measures can be undertaken to reduce these impacts.
Offshore Array - Substation: Installation, maintenance and removal of infrastructure		Construction Decommissioning	Yes	Piling and / or drilling is anticipated for installation of the offshore substation if fixed installation is decided. Should a floating offshore substation be taken forward, this would be

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Protected Subtidal Habitats and associated species (as listed in Table 6.8)				installed and attached to the seabed through drag anchors. However suction piles and drilled piles may be considered depending on ground conditions. Habitat is likely to contain mostly robust fauna that has limited sensitivity, and a wide area of A5.27 is available surrounding the Offshore Substation. There are no known Annex I habitats within footprint of the Offshore Substation. However, as the species present are not known, this impact will be taken forward to the EIA.
Inter-Array and Marine Export Cables (ECR): Installation/laying of cable and cable protection. **All Subtidal Habitats** and associated species along route.	May cause increased suspended sediment concentration and sediment deposition. May affect benthic habitats through smothering or decreases in water quality.	Construction Decommissioning	Yes	The amount of resuspended sediment is expected to be minimal, as is the footprint of any such sediment plume that will be detectable above background conditions (though this will depend on hydrodynamic conditions at the time). The majority of the project footprint is in an area of coarse sediment (i.e. sand) or rock, further reducing the likelihood for notable sediment resuspension, though there are areas of fine / muddy sand in the nearshore. The species present (aside from Annex I habitats) are not well known, therefore it is not possible to determine their sensitivity to this effect, and as such it is scoped into the EIA.
	Dynamic submarine power cables connecting the platform to the seabed may result in electromagnetic fields (EMF) emissions generated by current flow passing through the cables. Although armored, these will not be buried in the seabed.	Operational	Yes	The potential impacts from dynamic submarine power cables on benthic receptors may not be of significance overall where studies have reported minor or non-significant effects from EMF emissions. However, as there is an uncertainty regarding this potential impact on benthic species, as such it is scoped into the EIA.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
	May cause changes in predator/prey interactions, behaviour, and physiological and developmental effects on benthic invertebrates (e.g. decapods, cephalopods or cnidarians)			
General Project Activities (including vessel movements) **All Habitats** and associated species in Study Area.	Pollution of water and sediment through accidental release of pollutants or chemicals from vessels. May affect subtidal benthic and intertidal ecology throughout the study area accessed by vessels.	Construction Operational Decommissioning	Yes	Accidental release has the potential to negatively impact benthic communities. Although the likelihood of this impact is extremely low given the industry standard mitigation measures that are expected to be put in place (see Section 6.2.5), as there is the potential for an impact, as such it is scoped into the EIA.
	Potential introduction and spread of Invasive Non-native Species (INNS via vessel hull or ballast water, and the introduction of new structures to provide suitable substrate for such species. Can cause displacement of local fauna, species and habitat loss.	Construction Operational Decommissioning	Yes	Vessels used during the project may inadvertently transport INNS. This can have significant impacts on local fauna through displacement, and the effects may not be restricted to the immediate area as any INNS could spread rapidly. It is possible that infrastructure will be brought into and out of the nearby Pembroke Dock, and the introduction of the structures themselves may allow a localised spread of any already established INNS populations in the region. As such, impacts from priority marine species [13] will be assessed in the EIA.
	Project infrastructure can cause changes in hydrodynamic regime, which can in turn impact the benthic ecology through inter-related effects.	Operational	No	There is expected to be minimal subsea infrastructure due to the semi-submersible nature of the Project. Subject to final design of the offshore substation, there is likely to be one jacket structure for the offshore substation.

[13] Priority marine species as detailed in: https://gov.wales/sites/default/files/publications/2018-02/invasive-aquatic-species-priority-marine-species.pdf

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
				The changes to hydrodynamics are anticipated to be negligible, therefore it has been scoped out of the EIA.
	Introduction of new habitat in the form of project infrastructure, including cable protection, may affect the established environment by providing new habitat / ecosystem function.	Operational	Yes	This could be a potential benefit to the environment as it may increase presence of species that are known to use hard structures for protection or species that attach to similar hard substructures.

6.2.5 Potential Mitigation

The design and development of the proposed Project is not yet finalised. As part of the ongoing process, mitigation measures can be introduced and reviewed. Careful project planning will help to design out 'red-flag' consenting environmental impacts. Mitigation measures for the marine benthic and coastal ecology will potentially comprise:

- Avoidance of key sensitive habitats, where known, through pre-construction surveys and micro-siting of proposed Project infrastructure;
- Minimisation of the total footprint of the proposed Project;
- Discussion with the regulatory authorities and stakeholders on methods to reduce impact;
- With regards to accidental events:
    - Develop an Emergency Response Plan in accordance with standard protocols;
    - Compliance with International Maritime Organisation (IMO) / Marine and Coastguard Agency (MCA) codes for prevention of oil pollution and any vessels over 400 Gross Tonnage will have on board Ship Oil Pollution Emergency Plans;
    - All vessels to carry onboard oil and chemical spill mop up kits; and
- Compliance with guidelines on mitigating the introduction and spread of INNS (Biosecurity Management Plan).

6.2.6 Proposed Approach to Environmental Assessment

The approach to assessing impacts on benthic receptors will be based on the following stages:

- Review of existing relevant data and information;
- Acquisition of additional project-specific data to fill any gaps (see Table 6.10 below);
- Formulation of a conceptual understanding of baseline conditions;
- Consultation and agreement with the regulators regarding proposed assessment approaches;
- Determination of the worst-case scenarios;
- Consideration of embedded mitigation measures; and
- Assessment of effects using data analysis, numerical Modelling outputs, and expert-based judgements by the EIA team.

The assessment of effects on subtidal and intertidal ecology will be predicated on a Source-Pathway-Receptor (S-P-R) conceptual Model, whereby the source is the initiator event, the pathway is the link between the source and the receptor impacted by the effect, and the receptor is the receiving entity.

An example of the S-P-R conceptual Model is provided by marine export cable installation which disturbs sediment on the seabed (source). This sediment is then transported by tidal currents until it settles back to the seabed (pathway). The deposited sediment could smother and have an effect on the species on this area of the seabed (receptor).

Consideration of the potential effects of the Project will be carried out over the following spatial scales:

- Near-field: the area within the immediate vicinity (tens or hundreds of metres) of the offshore array area, the offshore substation, and along the marine export cable corridor; and
- Far-field: the wider area that might also be affected indirectly by the project (e.g. due to disruption of waves, tidal currents or sediment pathways).

Potential impacts from the following 3 main phases of development will be considered:

1. Construction phase;
2. Operation and maintenance phase; and
3. Decommissioning phase.

For ease of assessment and presentation, not every single benthic habitat will be assessed. Instead, similar types of habitats in terms of their sensitivity to potential impacts will be grouped to form Valued Ecological Receptors (VERs). The process and rationale of developing these VERs will be checked with NRW prior to the impact assessment work commencing so that all parties are in agreement on the key receptor groups.

Outputs from the physical process assessment, i.e. increased suspended sediment concentration, changes in sediment transport etc., will provide the basis of the benthic impact assessment, along with quantified values of temporary habitat disturbance and habitat loss derived from the final project design envelope.

Table 6.10 - Proposed Benthic Surveys to Inform the Environmental Impact Assessment

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Desktop Study	Benthic Study Area (offshore; nearshore; intertidal)	Autumn 2021	1. To characterise the baseline in terms of occurrence within the Study Area. This will help identify any gaps in the existing data, to inform survey needs. 2. To assess the potential level pressure pathways and receptor sensitivity information to be referenced / used. Also, to identify cumulative effects with existing activities. 3. All outputs will be used to inform the EIA and HRA.
Project-Specific Benthic Survey Sub-Tidal: Sidescan Sonar Survey; Drop Down Video; Grab Intertidal: Unmanned Aerial Vehicles survey	Offshore Array including Offshore substation; export cable corridor; Intertidal region	Spring 2022	1. To gain a thorough understanding of the baseline subtidal and intertidal benthic environment, particularly the distribution of benthic habitats and species within the offshore array area and along the export cable corridor / landfall. 2. Data will be used to inform the EIA and HRA.

6.3 Fish and Shellfish Ecology

6.3.1 Study Area

For the majority of fish and shellfish species, the study area is focused on the offshore elements of the main EIA scoping area. For certain migratory species, the study area is larger, to account for the mobile nature of these species.

6.3.2 Baseline Data

Data on fish and shellfish ecology in the study area has been collated from the following sources:

- Marine Information Network (MarLIN);
- Lle (Marine Planning Portal for Wales);
- National Biodiversity Network (NBN) Gateway;
- EMODnet (2020);
- Greenlink Interconnector Marine Environmental Statement – Wales (Greenlink Interconnector Ltd, 2019)
- Greenlink cable (Intertek, 2019); and
- Pembrokeshire Demonstration Zone EIA Scoping Report (Wave Hub, 2018); and
- Erebus EIA Scoping Report (MarineSpace Ltd, 2019).

6.3.3 Existing Baseline

The variable seabed conditions across the southwestern coasts of England and Wales support a wide variety of fish species, with distinct assemblages associated with particular seabed conditions. Sandy inshore areas support large numbers of juvenile flatfish and sand eel, with seasonal populations of sprat and herring (Intertek, 2018), while areas where the underlying bedrock is exposed are characterised by small species such as wrasse, gobies and blennies, as well as juvenile pollock. A number of demersal (bottom dwelling) fish spawn and have nursery grounds in the offshore and nearshore area, whilst pelagic (free swimming) fish such as mackerel and herring range widely within the region, migrating between summer feeding grounds and overwintering grounds (Cefas 2005).The fish communities present can be broadly categorised as migratory (which encompasses diadromous species), demersal, pelagic, and benthopelagic.

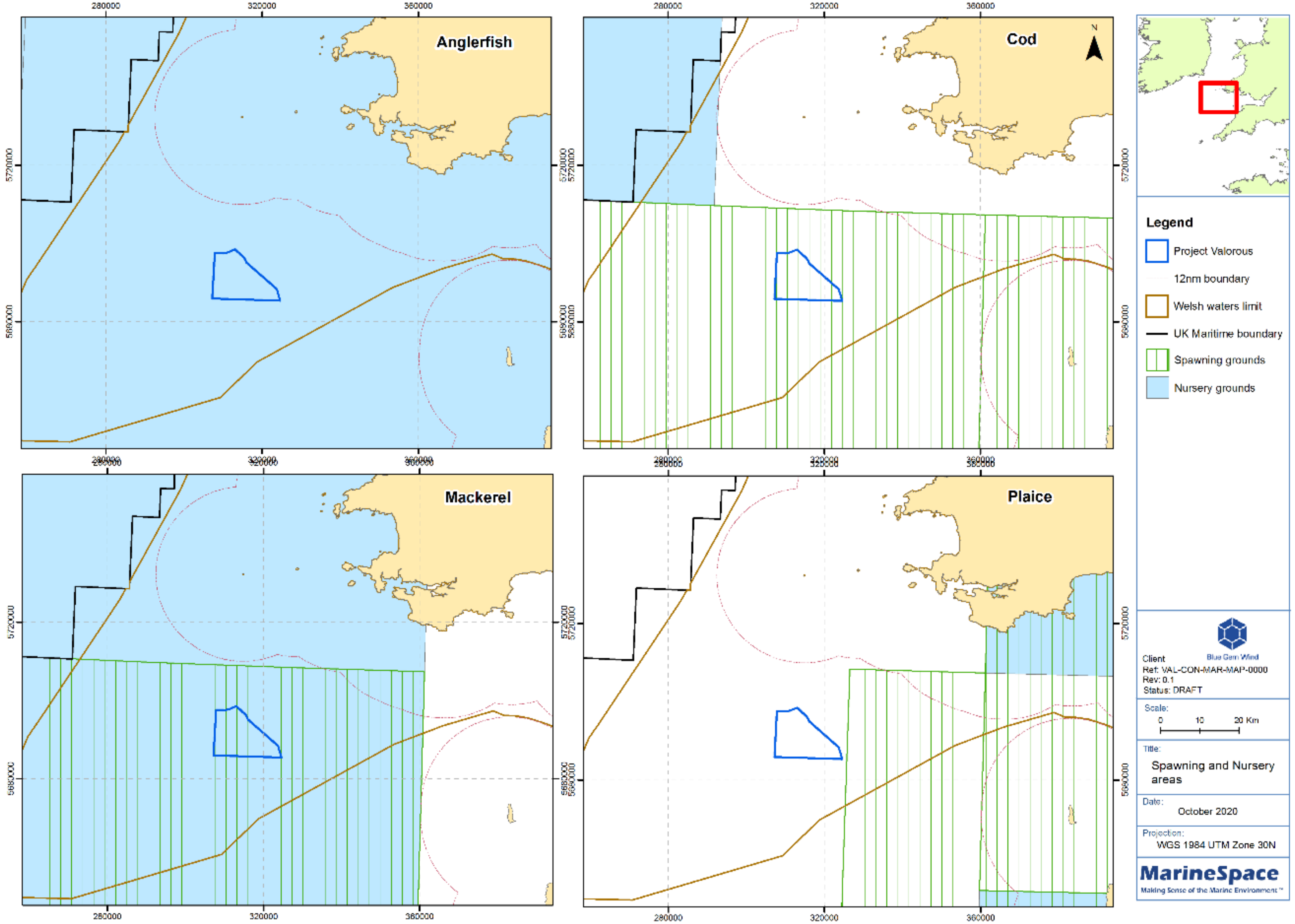
Information presented in the Erebus EIA Scoping Report (MarineSpace, 2019) and Pembrokeshire Demonstration Zone EIA Scoping Report (Wave Hub Ltd, 2018) indicates that commonly occurring and notable demersal species in this region include cod *Gadus morhua*, plaice *Pleuronectes platessa*, sole *Solea solea*, lemon sole *Microstomus kitt*, and several species of ray *Raja* spp. All these species also have spawning and / or nursery grounds within the region. Data derived from Coull *et al.* (1998); and Ellis *et al.* (2012) are presented in Intertek (2018) and provide further information on fish spawning and nursery areas for fish-stocks in the region. Data indicate that there are spawning grounds for 9 commercially important fish species in the region, and a nursery for eleven commercially important fish species (Figure 6.5 and Table 6.11).

Additional information is presented with respect to the potential for herring and sand eel spawning grounds in this region. Both these species produce demersal eggs (eggs laid onto or into seabed sediments) and are, therefore, particularly susceptible to impacts from offshore projects.

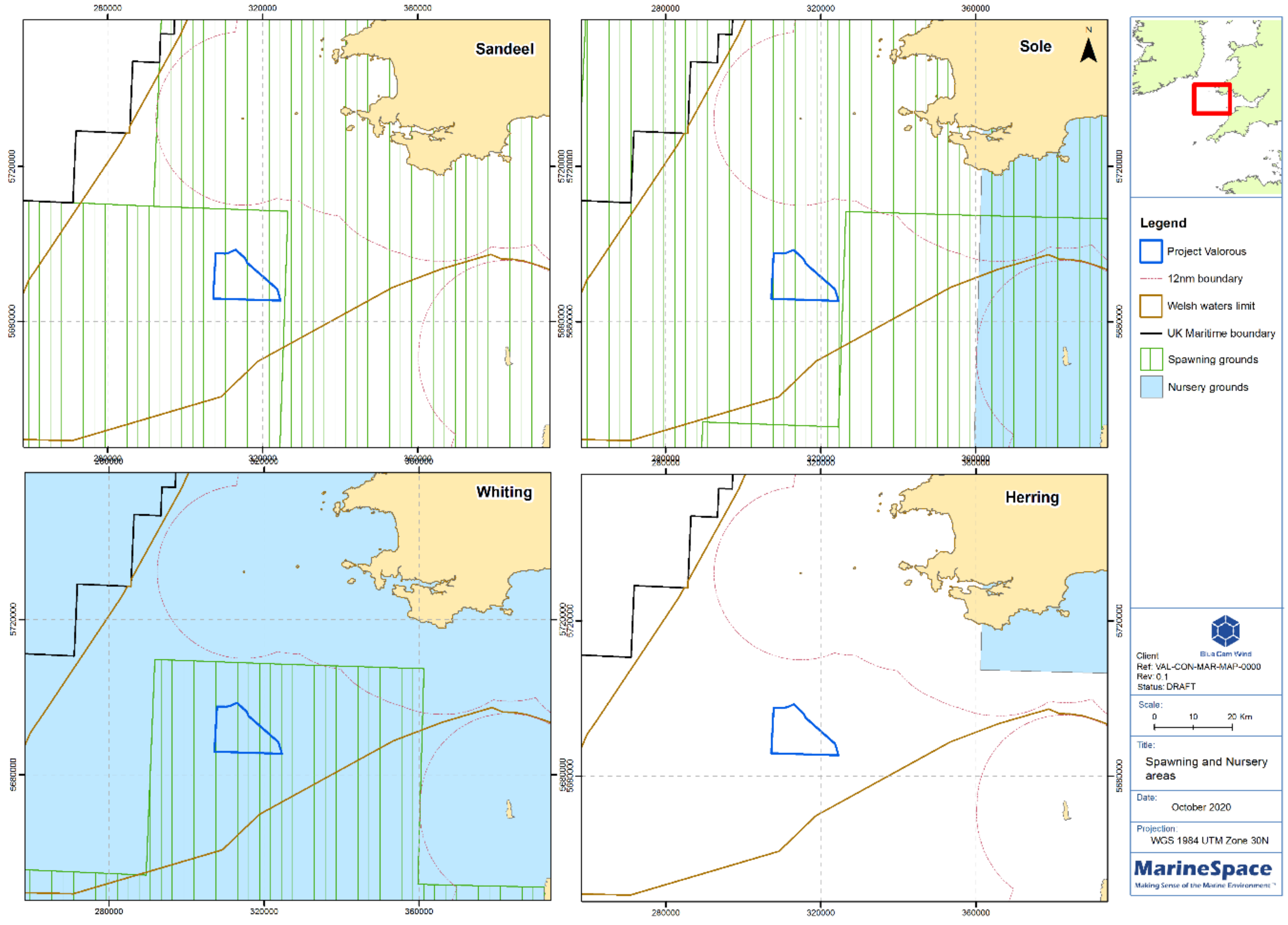
The spawning habitat potential has been determined using a methodology developed by MarineSpace for use in the EIA process for the marine aggregate industry (Figure 6.6).

Figure 6.5 – Spawning and Nursery Grounds within Proposed Project Area (Ellis *et al*, 2012) (Figures a – c)

(a) Spawning and Nursery Ground within Proposed Project Area for Anglerfish, Cod, Mackerel and Plaice



(b) Spawning and Nursery Ground within Proposed Project Area for Sandeel, Sole, Whiting and Herring



(c) Spawning and Nursery Ground within Proposed Project Area for Spotted Ray, Thornback Ray and Tope Shark

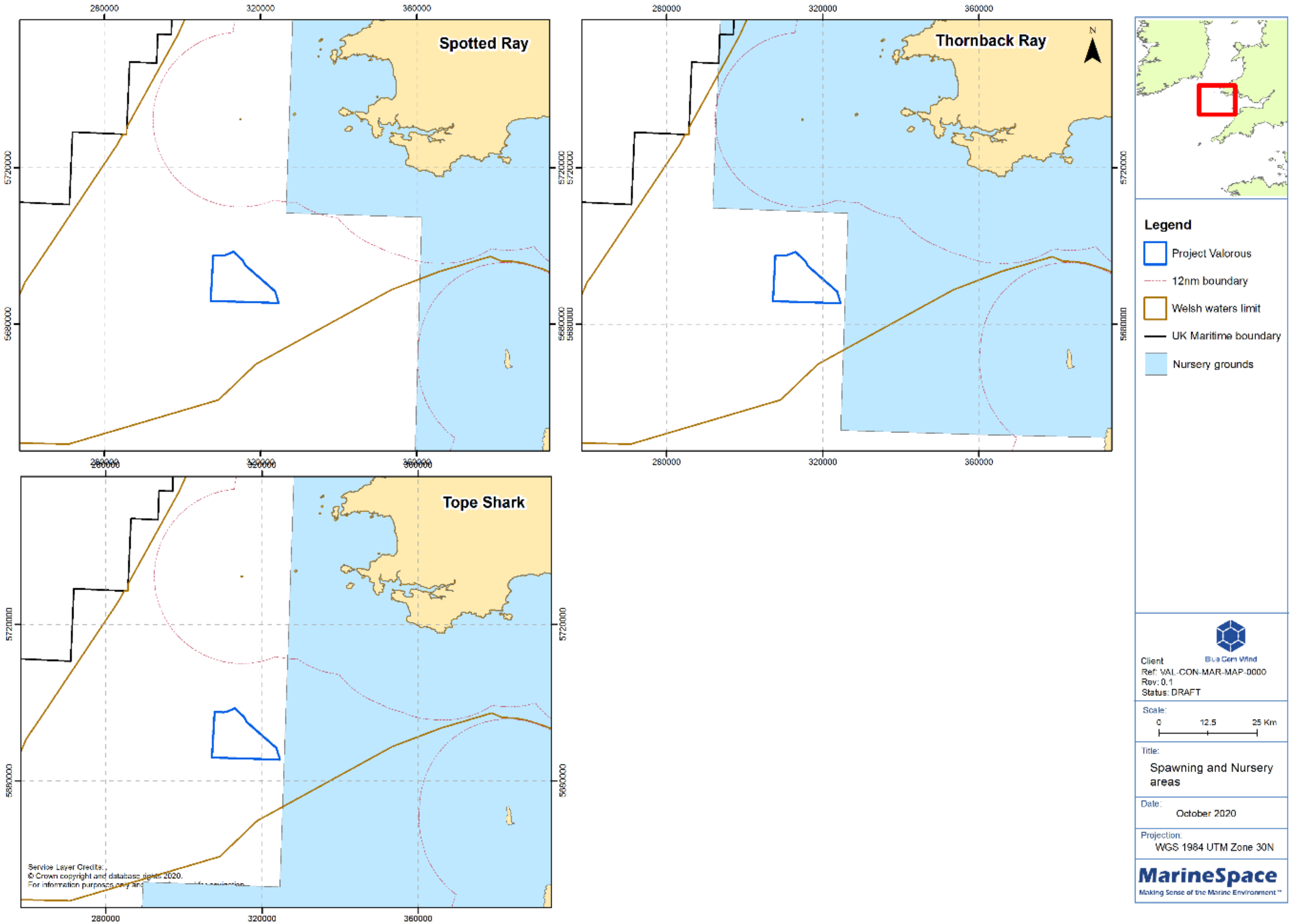


Figure 6.6 - Herring and Sandeel Spawning Potential in Study Area (MarineSpace, 2019)

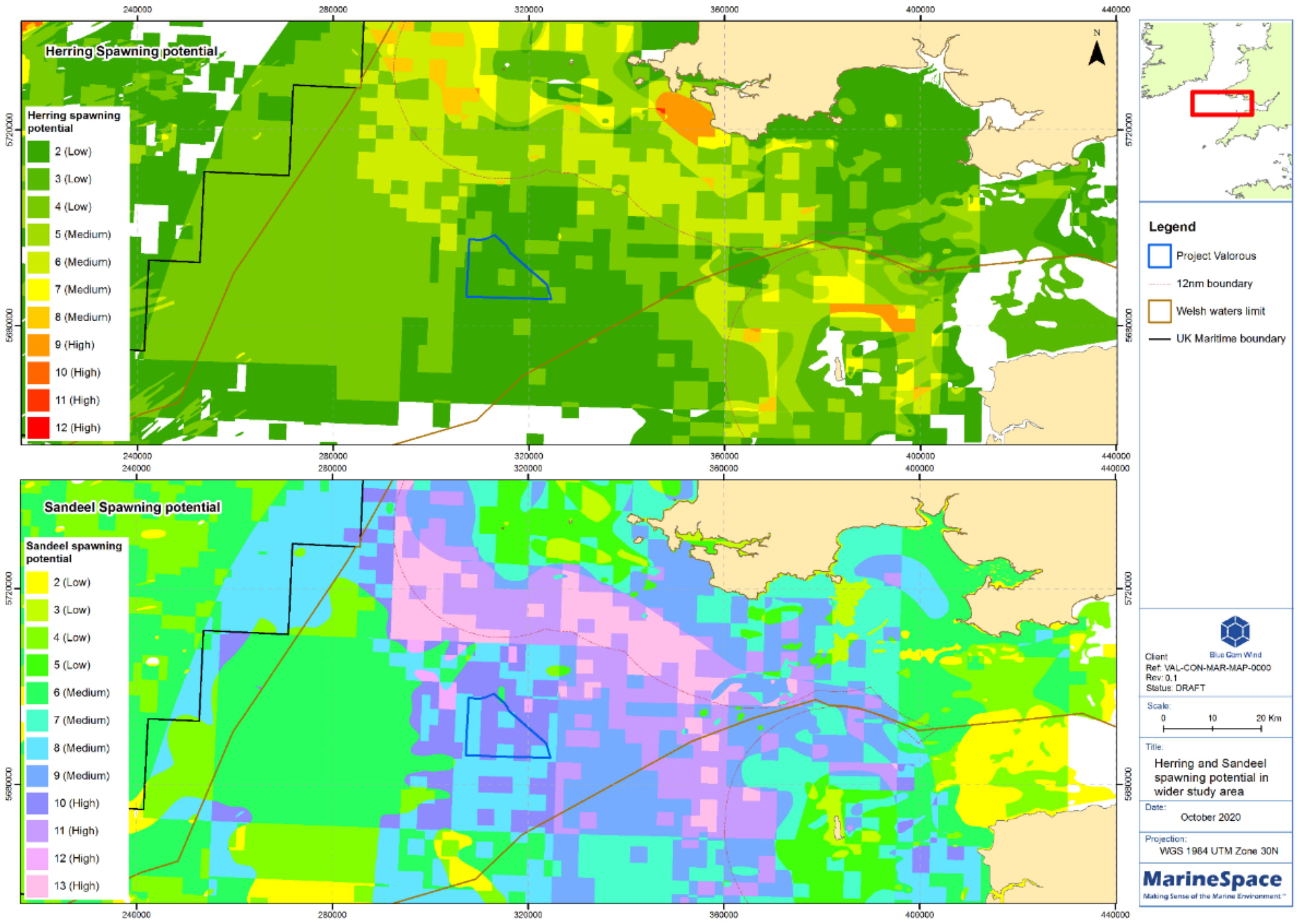


Table 6.11 - Summary of Spawning and Nursery Areas for Commercially Important Species in the Bristol Channel and Celtic Sea. (From: Intertek, 2018)

Species	Spawning period	Nursery period	Spawning aquatic zone
Atlantic cod *Gadus morhua*	-	Jan – Jun	Demersal
Mackerel *Scomber scrombrus*	-	Mar - Sep	Pelagic
Lemon sole *Microstomus kitt*	Apr - Sep	Apr - Nov	Demersal
Norway lobster *Nephrops norvegicus*	Gravid females and juveniles can be found all year round		Demersal
Whiting *Merlangius merlangus*	-	Feb - Aug	Demersal
Tope *Galeorhinus galeus*	Viviparous species (gravid females can be found all year).		Demersal
Sprat *Sprattus sprattus*	May - Aug (Peak May - Jun)	-	Pelagic
Atlantic herring *Clupea harengus*	Jan - Apr	-	Demersal
Anglerfish *Lophius piscatorius*	-	Jan – Aug	Demersal
Blue whiting *Micromesistius poutassou*	-	Apr - Aug	Pelagic
Ling *Molva molva*	Feb - May	Feb - Jul	Pelagic
Thornback ray *Raja clavate*	Feb - Nov*	Feb - Nov	Demersal
European hake *Merluccius merluccius*	-	Jan – Aug	Demersal
Sand eel *Ammodytidae*	Nov - Feb	-	Demersal
Sole *Solea solea*	Mar - May (Peak spawning April)	-	Demersal

Intertek (2018) also highlights the importance of sea bass *Dicentrarchus labrax* around the coast of south Wales, with areas around the coast likely to form sea bass nursery areas. Welsh Government and the MMO has implemented fishing regulations to protect juvenile stocks of sea bass and this species has also been placed under special protection measures, following an increase in the fishing pressure and a reduction in reproduction (Intertek, 2018).

Of the demersal species present in the area, sand eel *Ammodytes* sp. and Atlantic herring *Clupea harengus* are particularly sensitive to seabed disturbance, such as that which may arise via construction activities associated with this proposed Project.

Sandeel

Sandeel exhibit diurnal and seasonal habits, burying themselves overnight, and over-winter, around 4-6 cm below the surface of sandy sediments (Holland *et al.*, 2005). During the spring and summer sandeel also exhibit diurnal habits, leaving the sediment habitat during daylight to feed on phytoplankton and zooplankton, and returning to bury themselves in the sediment during the periods of darkness.

Sandeel are an umbrella species in the marine ecosystem linking primary production at the base of the food chain associated with plankton to apex predators at the top, such as pinniped seals and seabirds. During the late 1980s and early 1990s overfishing and adverse environmental conditions led to dramatically reduced levels of juvenile sandeel recruitment resulting in catastrophic impacts on the numerous seabird populations which relied upon them as food.

A study by Holland *et al.* (2005) showed that areas which contained a high proportion of medium and coarse sand (particle size 0.25 to 2.0 mm) were preferred seabed habitats for sandeel, however the fine sediment content (<63 µm) is also critical, such that a high percentage of sandeel habitat has a fines content below 2%, and above 4% fines the occupancy and density of sandeel is extremely low. Sandeel may display a high level of site fidelity making them potentially vulnerable at a sub-population level to direct habitat loss (removal).

Atlantic herring

Atlantic herring is an umbrella species, occupying an important part of the trophic network, and providing key ecosystem services. It is a critical prey species for many apex predators both as adults and as juveniles, colloquially referred to as whitebait. There are 3 southwest Ireland sub-stock population areas for Atlantic herring and, for most of the year, the different populations mix. However, during the spawning season, they migrate to separate spawning areas.

Atlantic herring has a specific habitat preference which limits the spatial extent of their spawning grounds. Sediment suitability for potential spawning grounds has been seen to range from Gravel through sandy Gravel to gravelly Sand on the Folk (1954) scale (Reach *et al.*, 2013). Whilst potential Atlantic herring spawning grounds appear to have a relatively wide range of suitable seabed habitat, their distribution is likely to be restricted within potential spawning grounds to discrete spawning beds found at a local scale (O'Sullivan *et al.*, 2013). This is because besides sediment type, they also require broader environmental characteristics and parameters such as oxygenation of sediments, near bed flow rates and micro-scale seabed morphological features e.g. ripples and ridges. This is further complicated as spawning beds may be used sporadically, laying unused for several years at a time, before being re-used. All suitable areas of herring spawning habitat are, therefore, important to maintain a resilient herring population.

Migratory fish

The Celtic Sea is an important migration route for migratory fish such as lamprey, salmonids and European eel *Anguilla anguilla*. Intertek (2018) reports that the sea lamprey *Petromyzon marinus* and river lamprey *Lampetra fluviatilis* are both listed on Annex II of the EC Habitats Directive and are a qualifying feature for the nearby Pembrokeshire Marine / Sir Benfro Forol SAC.

Adult river lamprey migrate through the SAC entering freshwater between October and December to spawn, while juveniles generally migrate downstream into estuaries and inshore waters in spring, though autumn migrations have also been recorded. Adult sea lamprey migrate through the SAC between March and June to spawn while juvenile sea lamprey migrate downstream between December and June (Intertek, 2018)

Twaite shad *Alosa fallax* and Allis shad *Alosa alosa* are both Annex II species on the EC Habitats Directive and are qualifying features of the Pembrokeshire Marine / Sir Benfro Forol SAC. In addition, they are also listed as UK BAP priority fish species. Shad spend most of their adult lives in the sea but spawn in rivers (or, occasionally, in the upper reaches of estuaries) in early summer.

The Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* may also be found in this region, and Atlantic salmon is listed on Annex II on the EC Habitats Directive. The European eel is also listed on Annex II of the EC Habitats Directive and is a UK BAP species.

Elasmobranchs (sharks, rays and skates)

Thornback ray *Raja clavata*, cuckoo ray *Leucoraja naevus*, small eyed ray *Raja microocellata* and spotted ray *Raja montagui* are all found in the region (DECC 2016). The thornback ray has both nursing and spawning grounds in the area and is therefore is vulnerable to cable activities (Ellis *et al.*, 2012).

Intertek (2018) indicates that basking shark *Cetorhinus maximus* is commonly seen at the surface in the summer months, particularly around the western coasts of the UK. The species is listed on the UK BAP as a priority marine species. The lesser spotted dogfish *Scyliorhinus canicula* and greater spotted dogfish *Scyliorhinus stellaris* is very abundant, and oceanic sharks such as blue sharks *Prionace glauca*, thresher shark *Alopias vulpinus* and mako sharks *Isurus oxyrinchus* may also make rare visits to the region (Intertek, 2018).

Shellfish

Brown crab *Cancer pagurus*, green crab *Carcinus maenas*, velvet crab *Necora puber*, spider crab *Maja squinado*, and lobster *Homarus gammarus* are all abundant in the region (Intertek, 2018). Catch statistics for Wales, reported by Intertek (2018) indicate that 5 known species of shellfish were landed into Wales between 2013-2017, crab, lobster, nephrops *Norvegicus norvegicus*, scallops *Pecten maximus* and whelks *Buccinum undatum*. Scallops are abundant on sandy sediments along the coasts of south Wales (DECC 2016).

Non-commercial Species (Recreational Angling)

Recreational sea fishing is popular in southwest Wales, with several locations where the activity is regularly undertaken (Fishing in Wales, 2020). There is information available from 10 sea fishing locations along the Pembrokeshire coastline around Milford Haven (Table 6.12). Whilst no distribution data is provided, the information available can be used to give an indication of fish species present in the region, near the shore, and at the potential cable landfall locations. British Sea Fishing (2020) identified St Brides Bay, located to the north of the entrance to Milford Haven, as a good angling spot for catching pollock *Pollachius pollachius*, bass, wrasse, dogfish species, bull huss *Scyliorhinus stellaris*, ray species, and conger eel *Conger conger*.

Table 6.12 - Fish species commonly caught at recreational angling locations around Milford Haven (Source: Fishing in Wales, 2020)

Location	Common Species
Marloes Sands	Bass *Dicentrarchus labrax*, dogfish, flounder *Platichthys flesus*, ray species
West Dale	Bass, dab *Limanda limanda*, flounder, ray species
Dale Beach	Bass, dab, dogfish, flounder, garfish *Belone belone*, mackerel *Scomber scombrus*, ray species, whiting *Merlangius merlangius*
Watwick Bay	Bass, dab, dogfish, plaice *Pleuronectes platessa*, pollock *Pollachius pollachius*, pouting *Trisopterus luscus*, ray species, whiting
Gelliswick Bay	Bass, cod *Gadus morhua*, pouting, rays, smoothhound *Mustelus mustelus*, turbot *Scophthalmus maximus*, whiting
Milford Haven	Bass, cod, dogfish, eel species, flounder, garfish, pollock, pouting, whiting, wrasse species
Angle Beach	Bass, dogfish, flounder, pollock
Freshwater West	Bass, dogfish, flounder, ray species
Flimston Bay	Bass, pollock

In addition to the aforementioned species listed in Table 6.12, Visit Wales (2020) notes that Milford Haven/Neyland, Pembrokeshire is an important area for recreational shark fishing in the UK. A fleet of charter boats operate out of the harbours in Milford Haven, taking customers to offshore angling locations. Species that have been recorded in the waters around Milford Haven include porbeagle *Lamna nasus*, thresher shark, blue shark, and mako shark (VisitWales, 2020). Although no information is provided on distribution or catch locations, the provided information provides an indication species that are potentially present in the offshore study area and along the proposed export cable corridor.

6.3.4 Identification of Key Sensitivities and Potential Impacts

Table 6.13 - Key Sensitivities and Potential Impacts to the Fish and Shellfish Receptors in the Study Area.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Demersal fish (spawning and nursery areas)	Habitat Loss / Disturbance Activities that have the potential to cause habitat loss and / or disturbance to spawning and nursery areas, including installation of moorings; marine export cable installation; cable protection.	Construction Operational Decommissioning	Yes	Species that lay their eggs on specific seabed types, such as herring, or species that live in specific sediments, such as sand eel, may be affected by activities that have the potential to disturb, alter or remove seabed sediments e.g. cable trenching. The significance of the impact would be dependent on methods, project design and location.
Demersal fish and shellfish	Increases in sediment or water temperature as a result of subsea cable operation.	Operational	No	The exact amount of heating depends on cable specification and surrounding sediment characteristics; however, heat will dissipate quickly, and any heating will only be marginally above baseline conditions. Based on monitoring data collected from numerous operational UK OWF projects, no impacts are expected to demersal fish species and shellfish in close contact with the seabed via increased water temperatures.
All Fish Species	Fish Aggregating Device effect of floating platforms.	Operational	Yes	There is the potential for floating platforms, anchoring devices, and offshore substation (potential jacket structure) to act as a fish aggregating device.
All fish species	Underwater Noise	Construction Operational	Yes	Underwater noise from the installation of the offshore substation (piling) and WTG anchors has the potential to displace migratory fish from their migration routes if

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
(including migratory species)	Impacts on fish species from underwater noise including UXO clearance.	Decommissioning		this passes through the offshore scoping area during construction. During the operational period, noise levels are expected to be significantly lower than those during construction. The sensitivity of fish to underwater noise is not well documented and pathways of migratory fish are not well understood once individuals leave rivers
Fish and shellfish adults and larvae	Increased turbulence in the area due to increased particle motion and vibration.	Operational	No	There is the potential for an increase in localised water turbulence as a result of vibrational forces originating from the turbine and floating platform structure. However, the impact of vibrational forces produced by offshore windfarms is unlikely to cause significant changes in local fish populations, with any disturbance caused by this increase in local turbulence being outweighed by the FAD effects of the floating platform (Langhamer et al., 2017). High intensity sounds (>200dB) have the capability to injure or kill fish eggs and larvae several metres from the sound source. However, it is highly unlikely that vibrational effects of wind farms would be capable of producing forces of this intensity (Vella et al., 2001).
Shellfish	Loss of shellfish habitat	Construction Operational	Yes	Loss of habitat through placement of devices and swept area of mooring cables has the potential to remove habitat for shellfish. The significance of this would be dependent on the final project design and the importance of the area for shellfish.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Fish and shellfish (including migratory fish)	Increased Suspended Sediment Concentrations Impacts on fish and shellfish through a decrease in water quality.	Construction Decommissioning	Yes	Construction methods that create sediment plumes also have the potential to release contaminants (if present) into the water column. This could result in decreased water quality that could impact on the health of fish and shellfish populations and potentially impact on the quality of commercial species. The significance of the impact will depend on the construction methodology, the presence of contaminants and the abundance of species in the offshore scoping area.
Fish and shellfish	Loss of Habitat Reduced resource availability	Construction Operational Decommissioning	Yes	The loss or alteration of habitats within the development have the potential to impact on resource availability and prey distribution within the offshore scoping area. The significance of the impact will be influenced by the extent of any change to benthic habitats and the importance of those areas as a resource.
Fish and Shellfish	There is potential for electromagnetic fields (EMF) and thermal effects from transmission assets to have influence on the behaviour of fish and shellfish in the local area.	Operational	Yes	EMF emissions and thermal increase may arise in the immediate area around Project transmission assets. However, where they occur these changes are only discernible within the immediate vicinity of the transmission infrastructure. The extent affected will constitute a very small proportion of the total habitat available, therefore it is unlikely that this will result in a significant effect.
Migratory fish	EMF as a barrier to migratory fish	Operational	Yes	Potential EMF effects on fish species has been investigated and there is no clear evidence of any

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
				adverse impacts as demonstrated in previously assessed and consented offshore wind farms (OWF). Post-construction monitoring of fish in operational OWF projects around the UK has shown no absence of electro-sensitive species (rays; dogfish) in these areas, indicating that installed subsea cables have no impact on these species. However, given there is uncertainty, EMF impacts will be considered within the ES.
All fish species (including migratory species)	Ghost fishing from lost fishing gear, entangled in the mooring system could pose an entanglement risk to fish.	Operational	Yes	There is a risk that fish using the area may become entangled with derelict fishing gear, though the likelihood of this is poorly understood. For previous FLOW projects in Scottish waters, Marine Science Scotland stated that they consider that the effects of "ghost fishing", whereby derelict fishing gear becomes entangled on the mooring lines and has the potential to then entangle fish, as very difficult to quantify at this stage.

6.3.5 Potential Mitigation

The specific requirements for mitigation depend on the assessed significance of the effects on fish and shellfish ecology. Mitigation measures will be developed as part of the proposed Project development and EIA as an iterative process; however, some key considerations are likely to include:

- Temporal mitigation – consideration of the timing of operations to avoid periods of high importance e.g. spawning times for demersal spawners; migration periods for key migratory species;
- Spatial mitigation – develop an understanding of key sediment types, particularly with regards Atlantic herring and sand eel in order to potentially mitigate effects through spatial zonation and / or siting of moorings / cable etc.; and
- Discussion with statutory consultees on the monitoring of mooring and cabling for ghost fishing gear to minimize entanglement.

6.3.6 Proposed Approach to Environmental Assessment

The proposed approach to the assessment of potential impacts on fish and shellfish is detailed below:

- Natural fish populations within the Study Area will be characterised via a review of existing literature and, existing environmental data such as bathymetric data and fish landings data from the MMO;
- No project-specific surveys on fish and shellfish populations are proposed;
- Feedback gathered from commercial fishermen on key target species via the commercial fisheries assessment will also be used to characterise the Study Area;
- Key receptor groups will be defined and used as the basis of the assessment, with the sensitivity of each receptor group clearly explained within the ES. There will be particular focus to Atlantic herring and sand eel with regards impact assessment of seabed disturbance to inform final cable route and proposed Project infrastructure locations and also migratory fish, from both an EIA and HRA perspective;
- Footprints of potential habitat loss/disturbance will be calculated and used as the basis of many of the impact assessments;
- Outputs of the physical processes assessment will also provide the basis of impact assessments related to increased suspended sediments;
- Potential impacts via subsea noise will be assessed through a desk-based assessment and, potentially, underwater noise modelling. Whilst subsea noise emissions are anticipated to be low, there may be a need for piling for the offshore substation installation and suctions / drilled piles for anchors (dependent on ground conditions);
- Reference will be made within the assessment to Models produced by the National Physical Laboratory (NPL) and also published response thresholds (Popper *et al.*, 2003; Hawkins *et al.*, 2014);
- The subsea noise assessment on fish will also take full account of conclusions of EIA for previous FLOW projects (HyWind; Kincardine; Dounreay Tri) where impacts on fish and shellfish ecology were concluded to be non-significant; and
- The subsea noise assessment will also take into account the consideration of vibration down anchoring cables, as well as the detonation of UXO and cable ‘snapping’ associated with cable tension release in the mooring system.

6.4 Marine Mammal and Marine Reptile Ecology

6.4.1 Study Area

The study area for marine mammals is focused on the offshore elements of the main EIA scoping area although consideration is given to more wide-ranging species in the region.

6.4.2 Baseline Data

Data on marine mammals in the study area has been collated from the following sources:

- Marine Life Information Network (MarLIN);
- Lle (Marine Planning Portal for Wales);
- National Biodiversity Network (NBN) Gateway;
- Erebus EIA Scoping Report (MarineSpace, 2019b) and available environmental data
- Greenlink Interconnector Marine Environmental Statement – Wales. (Greenlink Interconnector Ltd, 2019);
- Greenlink cable EIA Scoping Report (Intertek, 2016); and
- Pembrokeshire Demonstration Zone EIA Scoping Report (Wave Hub, 2018).

6.4.3 Existing Environment

A range of marine mammals, including cetaceans (whale, dolphins and porpoises) and pinnipeds (seals) are likely to occur within the marine Study Area. Marine turtles are the only species of reptile that may potentially be present. An overview of the key species in the Study Area is provided below and in Table 6.14.

More than 28 cetacean species have been recorded in UK waters; of these, 11 have regular presence. Approximately 15 species have been recorded in the Irish and Celtic Sea (Wave Hub Limited, 2018). 3 of these species are seen regularly in the Study Area; the harbour porpoise *Phocoena phocoena*, short-beaked common dolphin *Delphinus delphis*, and minke whale *Balaenoptera acutotostrata* (Baines and Evans, 2012; Wave Hub Limited, 2018). Seen less frequently is the Risso's dolphin *Grampus griseus* and common bottlenose dolphin *Tursiops truncatus* (Baines and Evans, 2012).

Species with rare occurrence in the wider region (Celtic and Irish Seas) are humpback whale *Megaptera novaeangliae*, fin whale *Balaenoptera physalus*, sei whale *Balaenoptera borealis*, northern bottlenose whale *Hyperoodon ampullatus*, Sowerby's beaked whale *Mesoplodon bidens* striped dolphin *Stenella coeruleoalba*, white-beaked dolphin *Lagenorhynchus albirostris*, Atlantic white-sided dolphin *Lagenorhynchus acutus*, killer whale *Orcinus orca*, and long-finned pilot whale *Globicephala melas* (NBN Atlas, 2020; Reid *et al.*, 2003). It is noted that humpback whale in particular have been sighted with increased frequency off the southwest Wales coast. Even though these species with rare occurrence are not likely to be present in the Study Area, the potential for presence of baleen whales in relation to potential entanglement risk is further commented on below.

2 species of pinniped are resident to the UK; the grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina*. Both have known haul out sites along the coastline of the UK and will forage in surrounding waters. Grey seals typically forage at greater distances from haul out sites than harbour seals (135 km and 120 km, respectively; SCOS, 2019).

Grey seals are present throughout Welsh waters and have many haul out sites and breeding sites around the coast, some of which are designated. Conversely, harbour seals do not have any designated sites in the Study Area and are only rarely recorded in the Study Area, therefore they have been scoped out of the assessment.

Marine mammals are protected through place-based conservation measures in terms of designated sites. Designated sites for marine mammals can comprise: Special Areas of Conservation (SACs), designated for species on Annex II of the Habitats Directive; Ramsar sites; and Nature Conservation Marine Protected Areas (NCMPAs), which occur in Scottish waters. An overview of the designated sites within the species-specific, biologically-relevant distance from project Valorous (IAMMWG (2015) marine mammal management units for cetaceans; established foraging ranges (SCOS, 2019) for seal species) are presented in Figure 6.7-Figure 6.10.

5 species of marine turtle have been recorded in the UK but the majority of these are vagrants and are not sighted regularly. The only species thought to be resident is the leatherback turtle *Dermochelys coriacea*. Leatherback turtles migrate through the Irish Sea whilst on passage between the southwest of Ireland through to Northern Ireland and the west coast of Scotland (Intertek, 2016), and as such pass through the Study Area.

6.4.4 Identification of Key Sensitivities and Potential Impacts

Marine mammals may be directly or indirectly impacted during all phases of the proposed Project. Table 6.15 details the key sensitivities and potential impacts on marine mammals during the construction, operation and decommissioning of the proposed Project, and whether the impact is scoped in or out of the EIA. It should be noted that although the topic / receptor group may be generalised (e.g. 'All marine mammals'), it may be that only certain species within the broader group will be significantly impacted by the proposed Project; this will be investigated further during the EIA.

Overall it is anticipated that the impacts to marine mammals are likely to be minor / negligible based on the sensitivities of the features and (estimated) low temporal and spatial scale and magnitude of the activities. This reasoning is based on review of the EIAs and Scottish Government decision letters/consents for other FLOW floating wind projects around the UK (Kincardine; HyWind; Dounreay Tri). This does not preclude a full assessment of the impact pathways that have been scoped in as part of the EIA.

6.4.5 Potential Mitigation

The level of mitigation required during the proposed Project will be proportionate to the anticipated level of impact on marine mammal and reptile species. The approach to mitigation will be discussed with the statutory consultees throughout the EIA process. The proposed Project design and development has not been finalised and mitigation measures can be incorporated and reviewed in an iterative process. It is anticipated the key mitigation measures will comprise:

- Pre-construction characterisation studies will be conducted in accordance with the advice provided by the statutory consultees;
- Discussion with statutory consultees on the design of mooring and cabling to minimize entanglement and also routine monitoring of the mooring lines to inspect for fishing debris and, where possible, removal;
- The method of construction will aim to reduce noise output where possible;
- Method of UXO detonation (if required) could reduce noise output where possible;
- Adhering to the JNCC Guidelines on marine mammals and underwater noise, with regards to visual and acoustic monitoring and operational mitigation requirements, for any piling activities, geophysical survey noise and potential UXO detonation;
- Vessels will travel at speeds below the threshold to cause injury to marine mammal species (appropriate threshold to be assessed as part of the EIA); and

- Nearshore operations will be timed to minimise overlap with key periods for seals (breeding, moulting).

Figure 6.7 - Designated sites for harbour porpoise (*Phocoena phocoena*) within the Celtic and Irish Sea Management Unit that project Valorous lies within

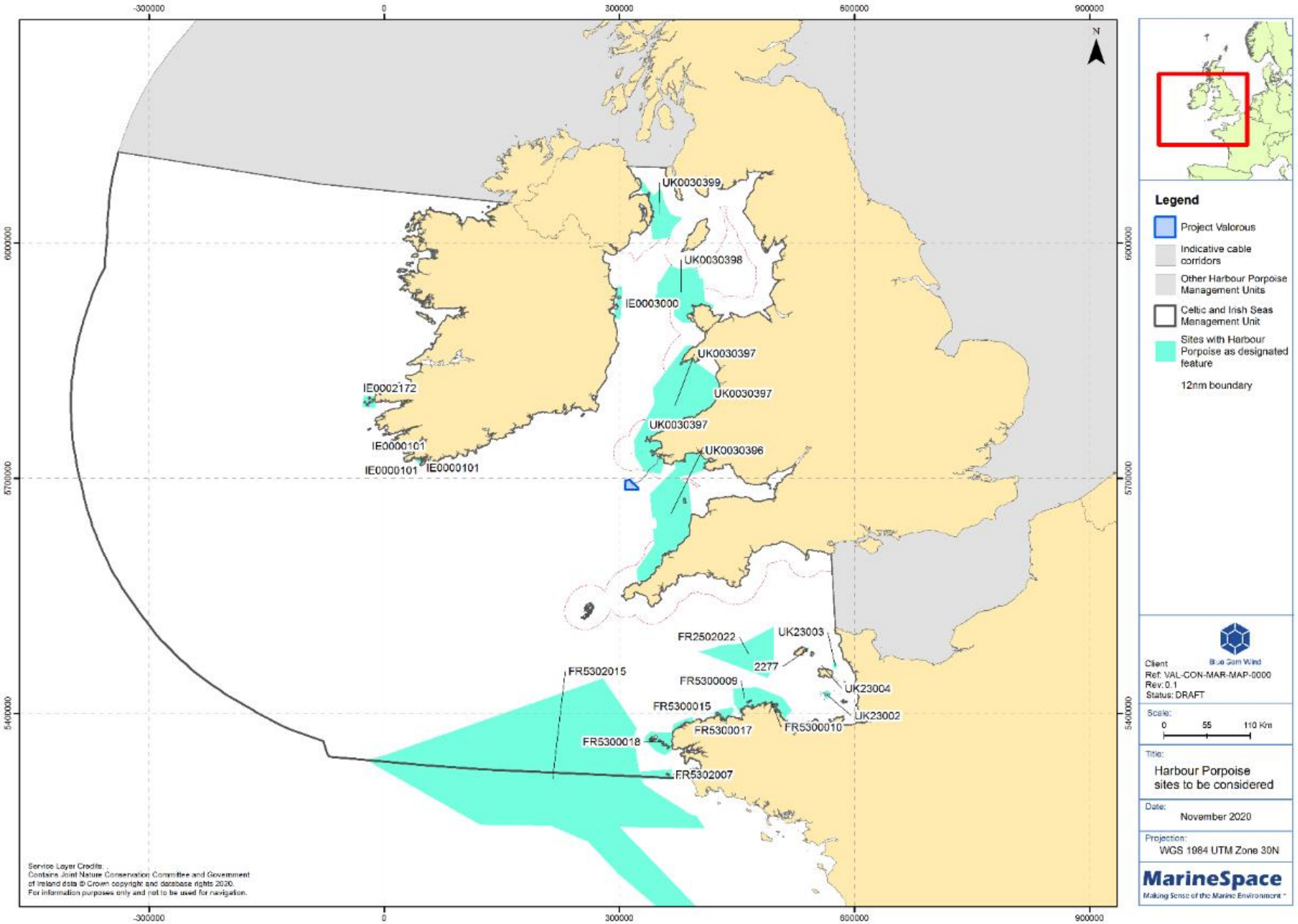


Figure 6.8 - Designated sites for short-beaked common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*), and minke whale (*Balaenoptera acutorostrata*) within the Celtic and Greater North Seas Management Unit that project Valorous lies within

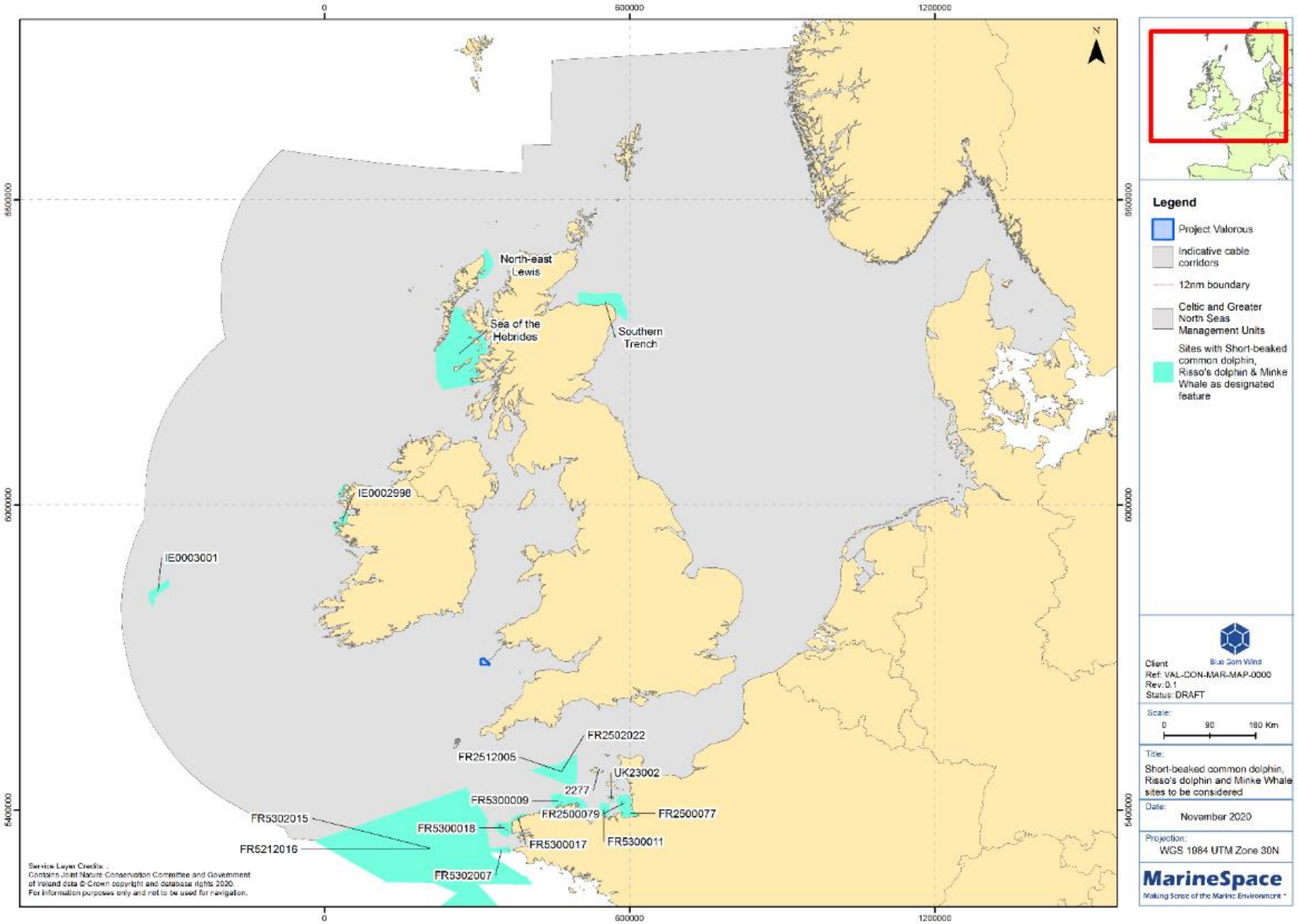


Figure 6.9 - Designated sites for grey seal (*Halichoerus grypus*) within the average foraging range (135 km; SCOS, 2019) from project Valorous

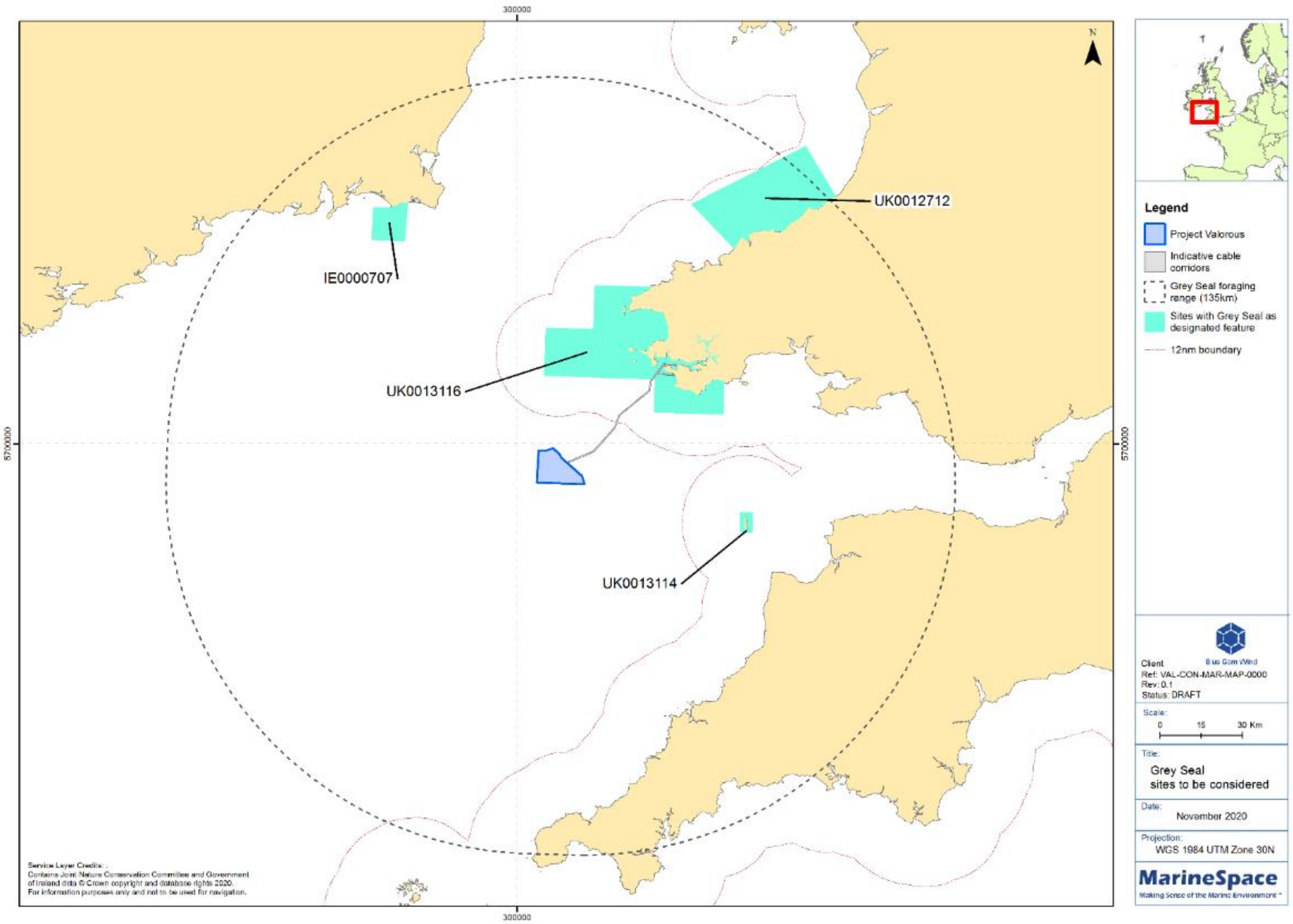


Figure 6.10 - Designated sites for harbour seal (*Phoca vitulina*) within the average foraging range (120 km; SCOS, 2019) from project Valorous

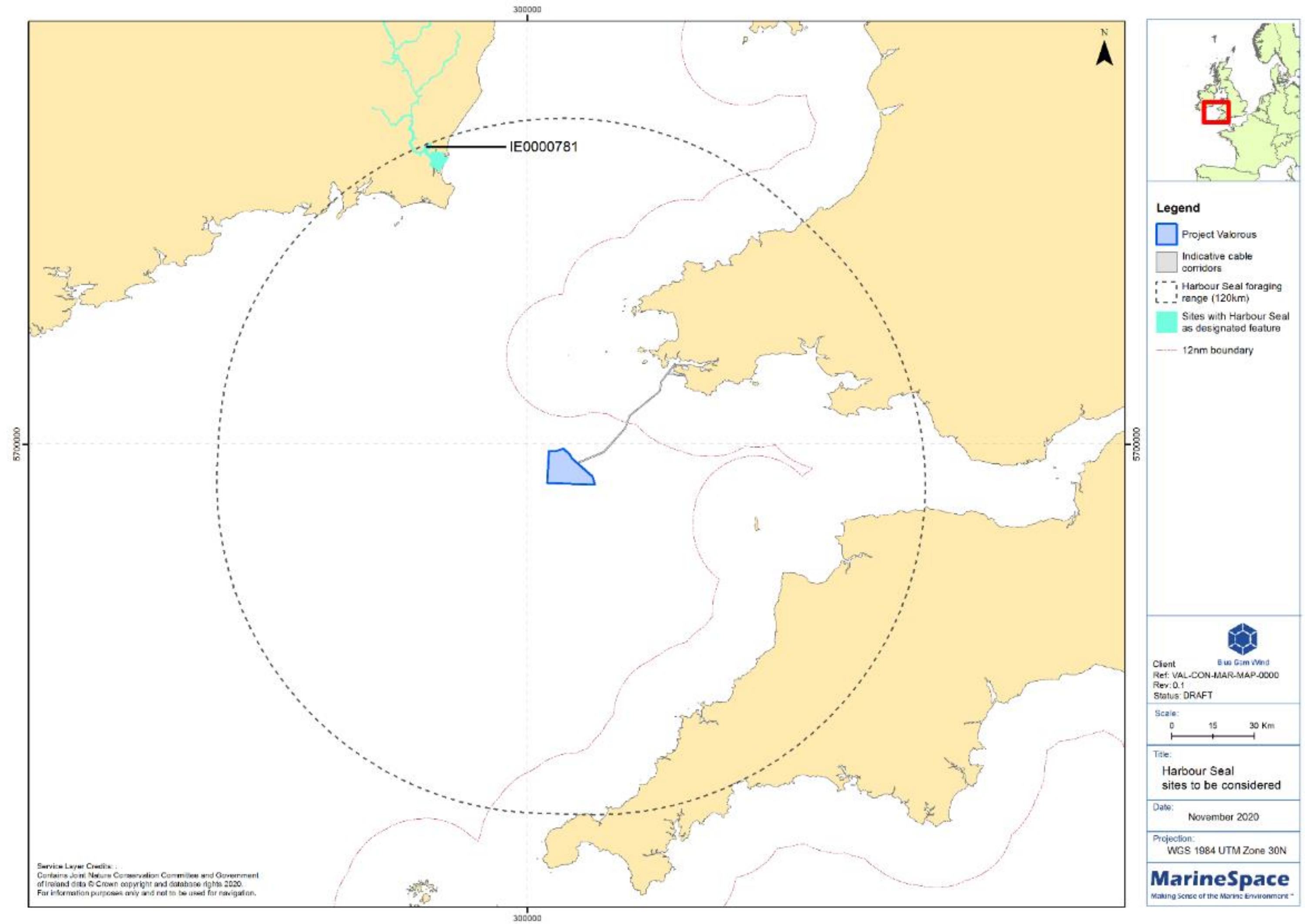


Table 6.14 - Species, Description and Protection Status in the Marine Mammal and Reptile Study Area

Species	Description	Protection Status
Harbour porpoise *Phocoena phocoena*	Found throughout the Study Area and around southwest Wales, in the Bristol Channel, throughout the Irish Sea and present but with lower densities in the Celtic Sea (Hammond *et al.,* 2017; Paxton *et al.,* 2016). Distribution is typically restricted to 200 m depth. The species is widespread throughout the West Wales Marine SAC and wider Study Area during summer; the winter range constricts to a smaller area in Cardigan Bay (JNCC, 2019a). Similarly, the Bristol Channel Approaches SAC is a key area during winter (JNCC, 2019b). Harbour porpoise density varies from <0.1 to 2.5 / 10 km in the proposed array area, with higher densities recorded inshore (from 2.5 to >10 / 10 km) (as derived from the Kriging interpolated maps; Baines and Evans, 2012).	Annex II and IV species Habitats Directive; Wildlife and Countryside Act 1981; CITES, OSPAR List of Threatened and / or Declining Habitats and Species; Section 7 Environment (Wales) Act (2016); Convention on Migratory Species. Listed as Vulnerable on the IUCN Red List (European population).
Short-beaked common dolphin *Delphinus delphis*	The species is observed offshore in the Bristol Channel and down through the southwest approaches and Celtic Sea; it is rarer in the Irish Sea (Baines and Evans, 2012; Hammond *et al.,* 2017; MarLin, 2020; Paxton *et al.,* 2016). Density of short-beaked common dolphin in the area is highly variable and can vary from <0.1 to >20 / 10 km, with densities of 1 to >20 / 10 km specifically in the proposed array area. It is mainly a summer visitor though can be seen further offshore in deeper waters through to November (Baines and Evans, 2012).	Annex IV species, Habitats Directive; Wildlife and Countryside Act 1981; CITES; Section 7Environment (Wales) Act (2016); Convention on Migratory Species. Listed as Least Concern on the IUCN Red List (Global Population).
Minke whale *Balaenoptera acutotostrata*	A largely offshore distribution, most common in the deeper waters of the Celtic Deep though also frequents the Irish Sea, particularly around southwest Wales and the Isle of Man (Paxton *et al.,* 2016). It is a summer visitor (Baines and Evans, 2012). Density in the Celtic Sea is highly patchy, ranging from <0.001->2 / 10 km, with density in the proposed array area itself between <0.001-1 / 10 km (Baines and Evans, 2012).	Annex IV species, Habitats Directive; Wildlife and Countryside Act 1981; CITES; Section 7 under Environment (Wales) Act (2016). Listed as Least Concern on the IUCN Red List (Global Population).
Risso's dolphin *Grampus griseus*	The species has a localised distribution around the coasts of the Irish Sea, including west Pembrokeshire (Baines and Evans, 2012). It is mainly seen in summer and autumn, with peak numbers in July to September. Densities are typically low in the area (<0.01 / 10 km), inclusive of the proposed array area, with the exception of small patches where it can exceed 5 / 10 km (Baines and Evans, 2012).	Annex IV species, Habitats Directive; Wildlife and Countryside Act 1981; CITES, Section 7 Environment (Wales) Act (2016); Convention on Migratory Species. Listed as Least Concern on the IUCN Red List (Global Population).

Species	Description	Protection Status
Common bottlenose dolphin *Tursiops truncatus*	Observed in the Irish Sea, particularly in Welsh coastal waters, though in lower numbers than harbour porpoise (Hammond *et al.,* 2017; MarLIN, 2020). Due to predominantly coastal distribution they are unlikely to occur in the project site in high numbers. This being said, the species was observed frequently in the offshore waters of the Celtic Sea (further offshore than the project site) by Hammond *et al.* (2017), who estimated that the Celtic Sea survey block supported a population of 2,938 individuals. There is a semi-resident but wide--ranging population in Cardigan Bay, comprising 289 individuals (2016 estimate; Lohrengel *et al.,* 2018). Numbers here increase through the summer and peak in late September / October. Numbers of sightings in the proposed array area are low (0-0.1 / 10 km), with considerably higher densities in Cardigan Bay (>0.1 / 10 km), and a small patch of slightly higher density (0.02-0.1 / 10 km) in Carmarthen Bay to the east (Baines and Evans, 2012). Breeding occurs year-round (Baines and Evans, 2012).	Annex II and IV species, Habitats Directive; Wildlife and Countryside Act 1981; CITES, Section 7 Environment (Wales) Act (2016); Convention on Migratory Species. Listed as Least Concern on the IUCN Red List (Global Population).
Grey seal *Halichoerus grypus*	Grey seals are present near the proposed Project site, though not directly in it (MarLIN, 2020). They have colonies that are designated as qualifying features of the Pembrokeshire Marine, Lundy Island, Cardigan Bay and Llŷn Peninsula and the Sarnau SACs. A breeding colony is also present on Skomer Island MCZ (Büche and Stubbings, 2018). The most recent August counts of grey seals at haul-out sites in Wales was 900 individuals (for the period 2015-2018; SCOS, 2019). The most recent estimate of pup production was 2,000 individuals, in 2016 (SCOS, 2019). With regards to the Skomer population specifically, it is estimated that 250 pups were born in 2018, therefore comprising approximately 1/8 of the Welsh population (Büche and Stubbings, 2018). There are numerous haul out sites around the Pembrokeshire peninsula, mainly off the coast of St David’s, with 50 to 150 non-breeding haul out counts between 1990 and 2007 (Baines and Evans, 2012).	Annex II species, Habitats Directive; Wildlife and Countryside Act 1981; Convention on Migratory Species. Listed as Least Concern on the IUCN Red List (Global Population).
Leatherback turtle *Dermochelys coriacea*	Leatherback turtles make extensive migrations and enter UK waters in the summer months, following swarms of their favourite prey, jellyfish. Wave Hub (2018) reported that high numbers were sighted in the wider area between July-September 2000. There are no nesting beaches in the UK.	Wildlife and Countryside Act 1981; CITES; OSPAR; Section 7 Environment (Wales) Act (2016); Convention on Migratory Species. Listed as vulnerable on the IUCN Red List (Global).

Table 6.15- Key Sensitivities and Potential Impacts for Marine Mammals

Topic / Receptor	**Potential Impacts**	**Project Phase**	**Further Assessment at EIA Stage (scoped in)**	**Rationale for Impact Scoped In/Out**
All marine mammals	Operations associated with the Project, such as vessel movements and installation of moorings and offshore substation, will produce underwater noise, which has the potential to affect marine mammal species (*note that UXO detonation is assessed separately below)*.	Construction Operational Decommissioning	Yes	Marine mammals are sensitive to underwater noise. They use underwater noise for prey detection, predator avoidance, communication, navigation etc. Increases in underwater noise can lead to physical and auditory injury, behavioral changes or masking. The amount of noise from the Project is expected to be limited in comparison to other offshore wind projects. Piling/drilling is anticipated for the construction of the offshore substation, and so will be temporally limited (see Section 4 (Project Description) and Section 7.9 (Underwater Noise and Vibration)). Other potential anchor solutions for WTG, such as suction and drilled piles, may also be utilized (depending on ground conditions), although not the preferred option. It is anticipated that there is potential for injury thresholds to be exceeded by this pathway, though this will be investigated through noise modelling as part of the EIA if required. Noise from other project sources are not expected to exceed injury levels, though disturbance by vessel noise, trenching, or cable and cable protection laying is possible. An assessment of the noise impact from the Project alone and in-combination will be undertaken in the EIA.
Marine reptiles	Operations associated with the Project, such as vessel movements and installation of moorings will produce underwater noise, which has the potential to affect marine reptiles.	Construction Operational Decommissioning	Yes	Little is known about the sensitivity of marine turtles to underwater noise, however recent research indicates that they are sensitive to low frequencies (peak hearing for leatherback turtles is 100-400 kHz; Piniak *et al.,* 2012) such as those produced during project operations. This impact is therefore scoped in for further assessment.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
All marine mammals and reptiles	There is potential for UXOs to be present in the area; if this is the case, their controlled detonation can cause injury to marine mammals and reptiles	Construction	Yes	The area is close to the Castlemartin firing range and so may contain UXOs. Controlled UXO detonation, if required, can cause lethal and sub-lethal injuries to marine mammals and reptiles, with the severity of injury decreasing with distance from the explosion. Though it is not certain that UXOs will be discovered, the impact has been scoped in due to its potential severity.
All marine mammals and reptiles	Increased collision risk from the vessels to be used during the Project, which may cause harm to marine mammal and reptile species.	Construction Operational Decommissioning	Yes	Both marine mammals and turtles have been known to be impacted by ship strikes, large cetaceans in particular. The likelihood of injury depends on the vessel speed. An assessment of the collision risk from the Project alone and in-combination with other projects and existing vessel traffic will be undertaken in the EIA.
All marine mammals and reptiles	Accidental and unplanned release of chemicals and pollutants from vessels used during the Project has the potential to cause harm to marine mammals and turtles.	Construction Operational Decommissioning	No	The risk of accidental and unplanned release of chemicals and pollutants from vessels is considered extremely low. An Environmental Management Plan (EMP) will be created, with procedures that will minimise the risk of such events and contain measures to minimise the impacts should they occur. This interaction is scoped out of the EIA.
All marine mammals and reptiles	Operations associated with the Project may cause sediment resuspension and so changes in water quality, which may impact the visual behaviour of marine mammals and reptiles.	Construction Operational Decommissioning	No	The marine mammal species common to the project site inhabit coastal waters that are often turbid, and so they will have a natural level of adaptation to increased sediment suspension. In addition, there is minimal suspended sediment expected to be generated due to the semi-submersible nature of the project, and the great water depth will restrict the effects to a small fraction of the water column near the seabed.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
All marine mammals and reptiles	Infrastructure associated with the Project may cause barrier effects from the mooring lines, which could disrupt the passage of marine mammals and turtles.	Operational	Yes	The configuration of the WTGs and moorings is currently unknown. This interaction has been scoped in as a precautionary measure however it is not expected to be significant and is likely to be scoped out upon further assessment.
All marine mammals and reptiles	Mooring lines and cabling between the platform and the anchors used during the project could pose an entanglement risk to marine mammals and reptiles.	Operational	Yes	There is a risk that cetaceans, pinnipeds and turtles using the area may get tangled in mooring lines. Large cetaceans (such as minke whale) are considered at greatest risk to this impact (SNH, 2014). The mooring lines may also become entangled with derelict fishing gear, which may further increase the chance of marine mammal entanglement (SNH, 2014), though the likelihood of this is poorly understood. For previous FLOW projects in Scottish waters, Marine Science Scotland (MSS) agreed that the risk of entanglement for marine mammals in any vertical mooring lines was very small, as was similar risk from catenary lines. MSS also stated that they consider that the effects of “ghost fishing”, whereby derelict fishing gear becomes entangled on the mooring lines and has the potential to then entangle marine mammals, as very difficult to quantify at this stage.
Pinnipeds	The presence of vessels close to the coast could lead to the disturbance of coastal and onshore habitats used by seals e.g. haul-out sites, breeding and foraging areas.	Construction Operational Decommissioning	Yes	Seals that are present at their coastal sites for breeding, moulting, and nearshore foraging, could be affected by vessels in this way. The level of disturbance is correlated with the distance from the vessel; at <900 m seals can exhibit a fleeing response, at 900-1,500 m the vessels is detectable, and at 1,500 m the vessel is not detectable. This impact will be further considered in the EIA.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
All marine mammals and reptiles	Subsea cables for the Project may emit electromagnetic fields (EMF), which can impact the navigation of marine mammal and turtle species.	Operational	No	Many marine mammal and turtle species make long-distance migrations and are thought to use the Earth's magnetic fields for navigation. There is no evidence of subsea cables associated with OWF project affecting these migrations, even with >25 operational UK OWF projects. Therefore, this impact is proposed to be scoped out of the EIA.
All marine mammals and reptiles	The Project operations have the potential to cause indirect effects to marine mammal and turtle species through impacts to their prey.	Construction Operational Decommissioning	Yes	All marine mammal and turtle species could be affected by changes to their prey as a result of the Project. An assessment of this will be undertaken in the EIA, taking into account the assessment of impacts to key prey species in the benthic ecology and fish and shellfish ecology chapters. This may include impacts that have been scoped out as a direct risk to marine mammals and reptiles, such as sedimentation.

6.4.6 Proposed Approach to Environmental Assessment

The potential impacts on marine mammals listed above will be assessed using the general EIA methodology set out within Section 3 (Proposed Approach to EIA). Each potential impact will be properly defined and agreed using expert judgement and through consultation with NRW.

A key part of the impact assessment for marine mammals will be agreeing the exact approach with NRW and JNCC. We are aware that currently there is potentially conflicting advice from SNCB's concerning assessment for impact to SACs designated for Annex II marine mammal species such as harbour porpoise, common bottlenose dolphin and grey seal. NE and JNCC advise that Annex II species should be assessed using the appropriate SAC boundary and relevant buffer distances from the source of underwater sound and pressure emissions. However, NRW currently advises that potential impacts on Annex II species should be assessed at the population scale using the appropriate Marine Mammal Management Units (MMMUs). MMMUs are regional sea-scale areas known to support populations / meta-populations of marine mammals, including the designated populations of SACs contained with the MMMU. This results in a much larger area of sea requiring assessment than an appropriately buffered SAC boundary.

Following agreement on approach and receptor definition, an assessment of significance will then be undertaken based on the sensitivity and value of the receptor and the magnitude of effect.

Provisional definitions of different impact significance on marine mammals is provided below:

- Major: Very large or large changes (either adverse or beneficial) to a receptor (or receptor group), which is important at a population (national or international) level because of the contribution to achieving national or regional objectives, or, a change expected to result in exceedance of statutory objectives and / or breaches of legislation;
- Moderate: Intermediate or large changes (either adverse or beneficial) to a receptor (or receptor group), which may be an important consideration at national or regional population level. Potential to result in exceedance of statutory objectives and / or breaches of legislation;
- Minor: Small changes (either adverse or beneficial) to a receptor (or receptor group), which may be raised as local issues but is unlikely to be important at a regional population level; and
- Negligible: No discernible change in receptor (or receptor group).

The primary impact pathway of concern for marine mammals is underwater noise. As specified in the Project Description (Chapter 4), the greatest source of underwater noise during the project life cycle will be from piling/drilling, which is anticipated to be used during the construction of the offshore substation. At this stage the details of the construction installation methods are still to be defined.

It is anticipated that most underwater noise sources from the project will produce noise and vibration levels that are not significant. The impact pathways from piling/drilling and UXO detonation have the potential to produce significant noise levels, though these will occur over limited time scales. Should piling be required, computational modelling of the underwater noise emissions will be undertaken, in order to determine likely impact ranges. Should drilling be required, the requirement for project-specific subsea noise modelling will be discussed with the regulators and key stakeholders, noting that drilling typically produces significantly lower source levels than piling. Any modelling that is undertaken will be using an approach and thresholds that is agreed by the regulators and key stakeholders.

Should UXOs be discovered in the project area and are required to be detonated as part of the project, a more detailed consideration of underwater noise modelling will be required. As above, the modelling approach and thresholds to be used will be agreed with the regulators and key stakeholders.

For the anticipated low-impact pathways, impacts via subsea noise will be assessed via a desk-based review of previous subsea noise results produced for other OWF projects. Reference will be made within the subsea noise assessment to previous assessments and conclusions of EIAs for previous FLOW projects (HyWind; Kincardine; Dounreay Tri), where impacts on marine mammals were concluded to be non-significant. The industry-standard injury thresholds for impacts to marine mammals will be used (NMFS, 2018; Southall *et al.,* 2019). A review of the behavioural dose response relationships of marine mammals to noise sources will be included.

Table 6.16 summarises the addition data collection proposed for the Project, in relation to marine mammals and reptiles.

Table 6.16 - Proposed Additional Data Collection for Marine Mammals and Reptiles

Data requirement	**Method**	**Justification**
Desktop study		
Marine mammal baseline data including sightings, distribution, abundance, sensitive periods and areas.	Request information from named consultees and statutory scientific advisors (e.g. MMO, NRW, JNCC and Sea Mammal Research Unit). Examples of existing data sources to be used include the Atlas of Marine Mammals of Wales (Baines and Evans 2012), the latest NBN Atlas data, the Special Committee on Seals annual report (SCOS, 2019), SCANS-III data (Hammond *et al.,* 2017), and revised Phase III analysis of the Joint Cetacean Protocol (JCP) (Paxton *et al.,* 2016).	To characterise the baseline in terms of spatiotemporal occurrence, density, and key periods. This will help identify any gaps in the existing data, to inform survey needs. To inform the EIA and HRA
Sensitivity of marine mammals to underwater noise and potential noise impact assessment	Desktop review of existing information, including noise produced by other floating wind operations and also other activities (bottom-fixed offshore wind, aggregates, fishing etc.), and the observed responses to underwater noise. Noise impact assessment will use established thresholds (e.g. NMFS, 2018; Southall *et al.,* 2019) and, in the case of piling/drilling, utilise a project-specific underwater noise model (if required). Should UXO detonation be required as part of the project, a more detailed consideration of underwater noise modelling may be required.	To assess the potential level of underwater noise that will be produced during the different construction activities and identify any gaps in the literature. Also to identify cumulative effects with existing activities.
Surveys		
Marine mammal baseline data including sightings, distribution,	Request information from named consultees and statutory scientific advisors (e.g. MMO, NRW, JNCC and Sea Mammal Research Unit). Examples of existing data sources to be used include the Atlas of Marine Mammals of Wales	To characterise the baseline in terms of spatiotemporal occurrence, density, and key periods. This will help identify any

Data requirement	Method	Justification
abundance, sensitive periods and areas.	(Baines and Evans 2012), the latest NBN Atlas data, the Special Committee on Seals annual report (SCOS, 2019), SCANS-III data (Hammond *et al.,* 2017), and revised Phase III analysis of the Joint Cetacean Protocol (JCP) (Paxton *et al.*, 2016).	gaps in the existing data, to inform survey needs. To inform the EIA and HRA

6.5 Ornithology

6.5.1 Study Area

The offshore ornithological Study Area covers all areas currently under consideration for installation of Project infrastructure and the surrounding area, and Special Protection Areas (SPAs) and seabird colonies that lie within species-specific foraging ranges of the Project area.

The seabird species-specific foraging ranges have been determined using information provided in Woodward *et al.* (2019), a report produced to inform Habitats Regulations Screening (HRA). The metric used for screening is the average maximum (mean max) foraging range plus 1 Standard Deviation (SD). presents the foraging ranges used for the screening process, as derived from Woodward *et al.* (2019).

Table 6.17 presents the foraging ranges used for the screening process, as derived from Woodward *et al.* (2019).

Table 6.17 - Mean maximum foraging range plus 1 standard deviation for species that have a foraging greater than 100 km (Source: Woodward *et al.*, 2019)

Common Name	Species	Mean Maximum Foraging Range Plus 1 Standard Deviation (km)
Atlantic puffin	*Fratercula arctica*	265.4
Black-legged kittiwake	*Rissa tridactyla*	300.6
Common guillemot	*Uria aalge*	153.7
European storm-petrel	*Hydrobates pelagicus*	336
Great skua	*Stercorarius skua*	931.2
Leach's storm-petrel	*Oceanodroma leucorhoa*	657
Lesser black-backed gull	*Larus fuscus*	236
Manx shearwater	*Puffinus puffinus*	2,365.5
Northern fulmar	*Fulmaris glacialis*	1,200.2
Northern gannet	*Morus bassanus*	509.4
Razorbill	*Alca torda*	164.6

Future of the Atlantic Marine Environment (FAME)/Seabird Tracking And Research (STAR) tracking data from the RSPB (as presented in Wakefield *et al.,* 2017) have also been reviewed. The greatest predicted foraging range of the 2 sources has been used in the scoping exercise (applying the precautionary approach), to scope in the maximum number of SPAs that could potentially be affected. FAME and/or STAR data are only available for the following species:

- European shag Phalacrocorax aristotelis;
- Black-legged kittiwake Rissa tridactyla;
- Common guillemot Uria aalge;
- Razorbill Alca torda.

These data show that colonies of these 4 species fall within the area of interest, although it should be noted that only razorbill use the area in any great intensity.

Although there is evidence that suggests northern gannet display density-dependent competition and colony segregation (Wakefield *et al.,* 2017), a precautionary approach has been used and all breeding colonies within the mean maximum foraging range plus 1 SD (315.2 ± 194.2 km; Woodward *et al.*, 2019) are scoped into assessment.

The proposed Project area of interest is in water depths of approximately 70-84 m below lowest astronomical tide and lies approximately 45.8 km to the southwest of the Pembrokeshire coastline. The offshore study area also covers the area within which the offshore cable will be routed. The offshore cable route has yet to be finalised but is likely to pass through water depths of 0-84 m.

A number of potential cable landfall sites have been identified with the final site yet to be selected. Potential sites under consideration include West Angle Bay, Angle Bay (Sawdern Point) Freshwater West and Angle Peninsula South Coast all on the south Pembrokeshire coast.

The onshore ornithological Study Area covers all areas in which onshore project infrastructure could be located. The precise location of the onshore cable routes and onshore substation is not yet known. The onshore cable routes will extend from the landfall to an onshore substation which is expected to be within 2 km of the Pembroke Power Station.

6.5.2 Baseline Data

The baseline environment section has been informed using the following key data sources:

- Bird Atlas 2007 – 2011 Mapstore (BTO, 2020);
- Analyses of European Seabirds at Sea (ESAS) data (Kober et al., 2010);
- Birds of Conservation Concern (BoCC) 4 the Red list for birds (Eaton et al., 2015);
- Seabird Monitoring Programme online database (JNCC, 2020a);
- State of Birds in Wales 2018 (Bladwell et al., 2018);
- Seabird Tracking Database (BirdLife International, 2020);
- FAME and STAR data (Wakefield et al., 2017);
- Mean maximum foraging ranges plus 1 standard deviation (Woodward et al., 2019);
- Wetland Bird Surveys (WeBS) counts (WeBS, 2020);
- NBN Gateway (NBN Atlas, 2020); and
- MAGIC Interactive map (Defra, 2020).

6.5.3 Baseline Environment

The primary legislation under which birds are protected in Wales are:

- The European Council Directive (2009/147/EC) on the Conservation of Wild Birds (the 'Birds Directive');
- The Wildlife and Countryside Act (WCA), 1981, as amended;
- The Conservation (Natural Habitats & c.) Regulations, as amended ('The Habitats Regulations'); and
- Species listed under Section 7 of The Environment (Wales) Act 2016.

A desk-based study of available data has been undertaken to identify which protected species or species of conservation concern are likely to be present in the offshore and onshore study areas using available data.

6.5.3.1 *Offshore Ornithology*

Ornithological interests within the offshore Study Area include seabirds, auks, divers, grebes, wildfowl, gulls, and terns that may use the area for foraging or other essential behaviours such as preening, displaying, bathing and loafing/resting at sea.

There are several SPAs designated for internationally important breeding seabird populations whose foraging ranges overlap with the offshore Study Area. A list of these sites and the species for which they are designated is presented in Appendix C. The designated features of the listed SPAs have the potential to interact with the proposed Project.

European Seabirds at Sea (ESAS) data for the area show that survey effort in the area is rather poor, however an analysis of available data for the period 1980 to 2004 indicates that in the breeding season, the region is of key importance for breeding Manx shearwater *Puffinus puffinus*, northern gannet *Morus bassanus* and black-legged kittiwake *Rissa tridactyla* (May-September) and Atlantic puffin *Fratercula arctica* (April-June) (Kober *et al.*, 2010). In the winter months, the area is of particular importance for common guillemot *Uria aalge* (October-April) and an extensive area further offshore to the southwest of the proposed Project area of interest is used by large numbers of wintering lesser black-backed gull *Larus fuscus* (September to April) (Kober *et al.*, 2010).

Seabird tagging data for the offshore Study Area show that lesser-black backed gulls tagged at Skokholm island use the Study Area and wider area extensively (Thaxter *et al.*, 2015). The data presented on the Seabird Tracking Database (BirdLife International, 2020) show that the offshore Study Area and wider area is also used extensively by razorbill *Alca torda* and is frequented by Atlantic puffin *Fratercula arctica* which have a very widespread distribution in the offshore Study Area and surrounding area.

The inshore coastal waters provide foraging habitat for European shag *Phalacrocorax aristotelis* which feed on a wide range of small fish that are caught on or near the seabed (Bladwell *et al.*, 2018).

Tern species that could be present in the Study Area during the breeding season are Arctic tern *Sterna paradisaea*, Sandwich tern *Thalasseus sandvicensis*, common tern *Sterna hirundo* and roseate tern *Sterna dougallii* which breed within the Anglesey Terns/Morwenoliaid Ynys Môn SPA (JNCC, 2017), approximately 190 km to the north of the Study Area.

All tern species are considered passage migrants through Pembrokeshire, primarily in autumn (scarcely in spring), with Arctic and Sandwich tern being the most commonly sighted (Pembrokeshire Bird Group, 2019).

In winter, the coastal waters provide important habitat for wintering wildfowl, divers and grebes. Common scoter *Melanitta nigra* is a common winter visitor to Pembrokeshire and is a designated feature of Carmarthen Bay SPA which is located approximately 65 km to the west of the study area. Few common scoters have been recorded outside of Carmarthen Bay (Pembrokeshire Bird Group, 2019).

The other seaduck species (velvet scoter *Melanitta fusca*, long-tailed duck *Clangula hyemalis,* scaup *Aythya marila* and pochard *Aythya ferina*) are scarce winter visitors to Pembrokeshire (Pembrokeshire Bird Group, 2019). Red-throated diver *Gavia stellata* commonly frequent the inshore coastal waters during the winter months in small numbers (typically 1-10 individuals per locality), and Milford Haven is considered a hotspot in Pembrokeshire (Pembrokeshire Avifauna, 2020). They are also passage migrants in spring and autumn. Great northern diver *Gavia immer* and black-throated diver *Gavia arctica* are also regular winter visitors to the coastal waters of Pembrokeshire, though the main sighting locations are outside the study area (Pembrokeshire Avifauna, 2020). All of the grebe species listed are uncommon winter visitors to Pembrokeshire (Pembrokeshire Bird Group, 2019).

Mediterranean gull *Larus melanocephalus* was first recorded in Pembrokeshire in 1968 and, since then, the species presence has grown, and it is now considered a regular winter visitor in small numbers (<10) (Pembrokeshire Avifauna, 2020). They are typically recorded in the Cleddau estuary, feeding inland during the day, but are rarely recorded in south Pembrokeshire (Donovan and Rees, 1994; The Wildlife Trust South and West Wales, 2020).

A wide range of other species that migrate to and from the UK may also pass through the offshore study area including seabirds, wildfowl, waders, passerines and raptors.

A summary of the protected species and other species of conservation importance that may be present or pass through the offshore study area is shown in Table C.1 (Appendix C).

6.5.3.2 *Onshore Ornithology*

Ornithological interests present within the onshore Study Area include coastal and terrestrial bird species that may breed, roost or forage within the area. There are a number of designated sites with ornithological interests within the area including SPAs and Sites of Special Scientific Interest (SSSIs) (see Section **Error! Reference source not found.**).

The final location of the cable landfall has yet to be confirmed however the potential locations are: Angle Bay, West Angle Bay, Freshwater West beach and Angle Peninsula South Coast between Whitedole Bay and Gravel Bay.

Freshwater West is within the Castlemartin Coast SPA, which is designated for breeding and wintering populations of chough (JNCC, 2001). This SPA provides important nesting and foraging habitat for 12 pairs of chough during the breeding season, and provides important foraging habitat for 24 pairs during the winter months. Other areas within the study area that hold important habitat for chough include the Skomer, Skokholm and the Seas off Pembrokeshire SPA and Angle Peninsula Coast SSSI both designated for breeding chough (JNCC, 2020b), and The Dale and South Marloes Coast SSSI which holds important breeding and wintering habitat for chough (NRW, 2002a).

The cliffs along the Castlemartin coastline, including Castlemartin Cliffs and Dunes SSSI, support the largest concentration of breeding seabirds on the Pembrokeshire mainland including common guillemot, razorbill, northern fulmar, European shag, black-legged kittiwake, herring gull and great black-backed gull (JNCC, 2020a). There are also a few records of lesser black-backed gull and Atlantic puffin. Broomhill Burrows SSSI is of importance for breeding lapwing *Vanellus vanellus*.

The onshore Study Area also holds important breeding habitat for a number of passerines; the key species in terms of conservation importance are listed in Table C.2 (Appendix C). Many species such as starling *Sturnus vulgaris*, marsh tit *Poecile palustris*, skylark *Alauda arvensis*, spotted flycatcher *Muscicapa striata*, yellowhammer *Emberiza citronella* and linnet

Linaria cannabina still breed in south Pembrokeshire, though declines have been recorded elsewhere (Pembrokeshire Avifauna, 2020). Increases in numbers and distribution have been reported for other species such as grasshopper warbler *Locustella naevia* and reed bunting *Emberiza schoeniclus*, with known breeding sites in the Study Area (Pembrokeshire Avifauna, 2020).

Common residents that breed throughout Pembrokeshire (including the Study Area) include bullfinch *Pyrrhula pyrrhula*, house sparrow *Passer domesticus*, dunnock *Prunella Modularis*, song thrush *Turdus philomelos* and mistle thrush *T. viscivorus* (Pembrokeshire Avifauna, 2020). Species considered unlikely to breed in the Study Area due to a decline in numbers and subsequent range retraction, include cuckoo *Cuculus canorus*, willow tit *Poecile montanus*, grey wagtail *Motacilla cinerea*, tree pipit *Anthus trivialis*, and lesser redpoll *Acanthis cabaret* (Pembrokeshire Avifauna, 2020).

The Study Area is also of importance for wintering waterbirds; Milford Haven supports an aggregation of 20,000-30,000 waterbirds each year (WeBS, 2020). The mudflats and saltmarshes of Milford Haven Waterway SSSI, including Angle Bay, support significant numbers of over wintering wildfowl and waders (NRW, 2002b).

Species of special interest include little grebe *Tachybaptus ruficollis*, shelduck *Tadorna tadorna*, wigeon *Anas penelope*, teal *Anas crecca*, dunlin *Calidris alpina* and curlew *Numenius arquata*. The most numerous wintering waders include curlew, with an average mid-winter population of approximately 3,000 birds, concentrated in northern Pembrokeshire. The most numerous wildlfowl is wigeon, with approximately 8,000 wintering in Milford Haven Waterway SSSI every year.

Large flocks of golden plover *Pluvialis apricaria* numbering several thousand birds are present at the Castlemartin ranges. Lapwing is found across farmland and coastal habitats in large flocks up to a few thousand birds. Passage migrants in spring and autumn include whimbrel *Numenius phaeopus*, black-tailed godwit *Limosa limosa* and bar-tailed godwit *Limosa lapponica*, seen in estuaries and coastal habitats in the study area. Only a few ruff *Philomanchus pugnax* are seen in the area in winter and spring. Woodcock *Scolopax rusticola* is a common winter visitor (tens of individuals) but does not breed in the area.

Brent geese *Branta bernicla*, Greenland white-fronted goose *Anser albifrons flavirostris*, and Bewick's swan *Cygnus columbianus bewickii* are scarce winter visitors and passage migrants to Pembrokeshire (Pembrokeshire Avifauna, 2020). All species are typically present in low numbers though larger aggregations (>10) can occur during cold weather periods. The main location that Brent geese are found is in Angle Bay where up to 9 birds have been recorded on occasion (Pembrokeshire Avifauna, 2020).

Raptors of conservation importance likely to be present in the onshore study area are listed in Table C.2 (Appendix C). Peregrine falcon *Falco peregrinus,* a scarce resident to Pembrokeshire, has been recorded breeding within the Study Area with nesting sites distributed along the coastline and also present in man-made structures, natural inland sites, and quarries (Pembrokeshire Avifauna, 2020; Wilson *et al.,* 2017). The Angle Peninsula Coast SSSI provides important breeding and foraging habitat for peregrine (NRW, 2003). Peregrines hunt widely across the whole of Pembrokeshire during the winter, particularly favouring the estuaries (Pembrokeshire Avifauna, 2020). Red kite *Milvus milvus* is a common resident species with an increasing population in Pembrokeshire, present in both the winter and breeding seasons, though with only one possible breeding site within the onshore Study Area (BTO, 2020; Pembrokeshire Avifauna, 2020). Kestrel *Falco tinnunculus* is a scarce resident and passage migrant; with coastal breeding sites present in the study area (Pembrokeshire Avifauna, 2020).

Hen harrier *Circus cyaneus* is a regular but scarce winter visitor to Pembrokeshire, rarely ranging south of the Cleddau estuary and not thought as likely to occupy southwest Wales

(Pembrokeshire Avifauna, 2020; Wotton *et al.,* 2016). Marsh harrier *Circus aeruginosus* is a scarce visitor and is mostly recorded at or near the coast (only in the north of the Study Area) (Pembrokeshire Avifauna, 2020). Goshawk *Accipeter gentilis* is a resident and winter visitor to Pembrokeshire, though the main population lies to the east of the Study Area (Pembrokeshire Avifauna, 2020). Merlin *Falco columbarius* is a winter visitor and migrant species occurring in small numbers, most frequently seen in coastal areas, and less commonly across farmland (Pembrokeshire Avifauna, 2020).

The Skomer, Skokholm and the Seas off Pembrokeshire SPA is also designated for breeding short-eared owl *Asio flammeus* (JNCC, 2020b). Short-eared owls are also frequently seen foraging over heaths and bogs during the winter months (Pembrokeshire Avifauna, 2020).

The Study Area may be used by large flocks of wintering passerines including fieldfare *Turdus pilaris*, redwing *Turdus iliacus* and also black redstart *Phoenicurus ochruros* (Pembrokeshire Avifauna, 2020).

A summary of the protected species and other species of conservation importance that may be present within the onshore study area is shown in Table C.2 (Appendix C).

Once the selection of locations for the onshore project infrastructure have been finalised, the need to gather further project-specific baseline characterisation data for each of these locations will be assessed.

6.5.4 Identification of Key Sensitivities and Potential Impacts

Given the preliminary nature of EIA Scoping, the potential impacts on ornithological receptors may only be broadly predicted, until completion of the project-specific baseline characterisation surveys and finalisation of the project description elements (e.g. offshore cable route, cable landfall site selection, substation location, onshore cable route and onward grid connection, etc.). The key sensitivities and potential impacts for offshore and onshore ornithological interests are presented in Table 6.18Table 6.18 and Table 6.19, respectively. These have been identified for each phase of the Project (construction, operation and maintenance and decommissioning).

6.5.5 Potential Mitigation

The findings of the project-specific surveys will inform the need for mitigation measures. Consultation with key ornithological stakeholders, including but not limited to NRW, JNCC, RPSB and The Wildlife Trust, will include discussion of the need for mitigation and the feasibility of potential options.

Time-related restrictions to onshore construction activities may be considered as an option to avoid disturbance to breeding birds.

Table 6.18 - Key sensitivities and potential impacts for offshore ornithology receptors

Topic/Receptor	Potential Impact(s)	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
All seabirds (divers, grebes, cormorant/shag, seaducks, tubenoses, gannet, gulls, terns, and auks)	Direct loss of seabed habitat used by foraging birds due to placement of project infrastructure.	Construction Operational Decommissioning	Yes	Placement of offshore project infrastructure may result in the loss of benthic habitat within the project footprint. This is likely to be limited to the locations of the electrical infrastructure and drag embedment anchor locations. The area of habitat disturbed by the anchors is likely to be very small and the resulting loss of prey resource is likely to be negligible. Where seabed conditions are not suitable for drag embedment anchors, pile driven or suction piles may be used as an alternative. The offshore bird surveys will provide data on the importance of these areas to foraging birds.
Diving birds (divers, grebes, cormorant/shag, seaducks, gannet, terns, and auks)	Disturbance (displacement) to birds due to noise from construction and decommissioning activities, including general vessel movements, piling and unexploded ordnance.	Construction Decommissioning	Yes	Data from construction and operational phases of OWF projects around the UK coast indicate that displacement of certain bird species can occur due vessel movements and piling operations during construction and decommissioning works.
Diving birds (divers, grebes, cormorant/shag, seaducks, gannet, terns, and auks)	Increased risk of auditory damage to diving seabird species from high intensity underwater noises such as piling and unexploded ordnance.	Construction Decommissioning	Yes	Underwater noise emissions, such as those from piling activities (installation of the offshore substation) and unexploded ordnance detonation, can result in disturbance and displacement effects, and may result in physiological damage if birds are near to the source of noise.
Diving birds (divers, grebes, cormorant/shag, seaducks, gannet, terns, and auks)	Reduction in foraging success of diving bird species due to increased noise emissions, such as	Construction Decommissioning	Yes	Underwater noise emissions can interfere with seabird predation success. Increased noise in the environment can result in disturbance and displacement, which can result in exclusion of seabirds from foraging areas. Additionally,

Topic/Receptor	Potential Impact(s)	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
	piling and unexploded ordnance.			underwater noises can affect prey species, reducing the availability of them to seabirds.
All seabirds (divers, grebes, cormorant/shag, seaducks, tubenoses, gannet, gulls, terns, and auks) and migratory birds (incl. waders and wildfowl)	Increased risk of mortality due to collision with WTGs.	Operational	Yes	Birds in flight are at risk of collision from WTGs. Key sensitivities include migrating birds and birds in transit between breeding sites and foraging areas. The offshore bird surveys will determine which species are present and the spatial and temporal distribution of flight activity through the wind farm area.
All seabirds (divers, grebes, cormorant/shag, seaducks, tubenoses, gannet, gulls, terns, and auks) and migratory birds (incl. waders and wildfowl)	Barrier effect of WTGs to regular movements of birds to and from breeding colonies or on migration.	Operational	Yes	The introduction of WTGs may result in a barrier effect to birds. Those species that make regular movements through the wind farm area between breeding sites and foraging sites or birds on migration are most sensitive. The offshore bird surveys will determine which species are present and the spatial and temporal distribution of flight activity through the wind farm area.
All seabirds (divers, grebes, cormorant/shag, seaducks, tubenoses, gannet, gulls, terns, and auks)	Displacement of birds from foraging or loafing areas due to effective loss of habitat if birds avoid the wind farm and its surrounds due to the physical presence of project infrastructure and maintenance activities.	Operational	Yes	The presence of offshore WTGs and associated project infrastructure and maintenance activities has the potential to result in displacement of birds from the wind farm and surrounding area. The offshore bird surveys will provide information to inform which species are present in the area and the spatial and temporal distribution of species using the site.
Diving birds (divers, grebes, cormorant/shag, seaducks, gannet, terns, and auks)	Disturbance to foraging diving birds from underwater noise and	Operational	Yes	Underwater noise and vibration from the operating WTGs may disrupt or interfere with the ability of diving birds to forage successfully.

Topic/Receptor	Potential Impact(s)	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
	vibration from operational floating WTGs.			The offshore bird surveys will provide information to inform which diving species are present in the area.
Diving birds (divers, grebes, cormorant/shag, seaducks, gannet, terns, and auks)	Ghost fishing from lost fishing gear caught around mooring lines and cables could pose an entanglement risk to diving seabirds.	Operational	Yes	There is a risk that diving seabirds may become entangled with derelict fishing gear, though the likelihood of this is poorly understood. For previous FLOW projects in Scottish waters, Marine Science Scotland stated that they consider that the effects of “ghost fishing”, whereby derelict fishing gear becomes entangled on the mooring lines and has the potential to then entangle diving seabirds, as very difficult to quantify at this stage.
Seabirds (cormorant/shag, gulls and terns)	Creation of roosting habitat for birds due to presence of floating platforms and associated infrastructure	Operational	Yes	The introduction of floating platforms and associated infrastructure presents the opportunity for new roosting habitat which may be utilised by foraging birds. The offshore bird surveys will provide information to inform which species are present in the area.
Seabirds (tubenoses)	Attraction of nocturnal seabirds (shearwaters and petrels) to lighting on project infrastructure	Operational	Yes	The potential for nocturnal species such as petrels and shearwaters to be negatively affected (attraction or disorientation) by lighting associated with project infrastructure is unknown and should be considered as part of the EIA process.
All coastal and terrestrial birds	Direct loss of breeding, roosting and foraging habitat due to the placement of project infrastructure	Construction Operational Decommissioning	Yes	The footprint of the onshore works may result in loss of breeding, foraging or roosting habitat. Onshore surveys will be required to determine which species and habitats are present and to inform placement and routing of infrastructure to minimise effects.

Table 6.19 - Key sensitivities and potential impacts for onshore ornithology receptors

Topic/Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact scoped In/Out
All coastal and terrestrial birds	Disturbance (noise and visual) to birds from installation and decommissioning activities	Construction Decommissioning	Yes	Construction activities for the onshore works may result in potential disturbance to breeding, foraging or roosting birds. Construction and decommissioning activities will be of limited duration and any disturbance effects will be temporary. Onshore surveys will be required to determine which species are present and to inform placement and routing of infrastructure to minimise effects.
All coastal and terrestrial birds	Displacement of birds from breeding, foraging or roosting areas due to effective loss of habitat if birds avoid the area due to the physical presence of project infrastructure and maintenance activities	Operational	Yes	The presence of the onshore substation and associated maintenance activities may result in the displacement of breeding, foraging or roosting birds within the surrounding area. Onshore surveys will be required to determine which species are present and to inform placement and routing of infrastructure to minimise effects.

6.5.6 Proposed Approach to Environmental Assessment

Key to ensuring that a robust impact assessment on ornithological receptors is carried out is making sure that robust data are available to inform the assessment. Based on current knowledge, a number of data gaps have been identified. Proposed approaches to gather these data to inform the EIA are outlined in Table 6.20.

A focus will be provided concerning the most likely significant effects which will be associated with risk of collision with the WTGs and also disturbance and displacement effects associated with the visual presence of the WTGs and, potentially, O&M vessels. The critical pressures will be informed by the proposed two-year ornithological survey, data from which will be used to develop and inform:

- Surface density plots and Models;
- Collision Risk Modelling (CRM); and
- Potential displacement modelling.

The project-specific offshore ornithological survey programme data will be presented in an EIA characterisation technical report to focus on the individuals recorded within, and abundance estimates for, the offshore array area only:

- Data and abundance estimates will be presented for all species recorded within the buffer area to permit the analysis of potentially displaced individuals;
- Raw counts will be divided by the number of images taken to give mean number of birds per image (i). Abundance estimates (N) for each survey month will then be generated by multiplying the mean number of birds per image by the total number of images required to cover the entire study area (A):

$$N = iA$$

- Dividing the monthly abundance estimates by the size of the study site or the 4 km buffer sites will then enable the calculation of density for any given species.

The project-specific offshore ornithological survey programme will also collect flight height data for each of the relevant species recorded within the proposed ornithological Study Area (area of the array plus a 4 km buffer). Data collected from the Digital Aerial Surveys (DAS) will be processed from the digital images captured.

The Potential Collision Risk Height (PCH) will be determined (currently defined as 30-270 m, depending on turbine capacity), as this represents the minimum and maximum sweep of the proposed turbine blades. Collision risk Modelling can also be informed by relevant literature and Models, to supplement and further refine the data collected during surveys.

Where Displacement Modelling is required, it will follow the guidance note from UK SNCBs entitled ‘*Joint SNCB Interim Displacement Advice Note: Advice on how to present assessment information on the extent and potential consequences of seabird displacement from offshore wind farm developments.*’

By following this guidance, an estimate of percentage displacement from the disturbance zone and percentage mortality within displaced birds will be made.

Displacement can arise from the vessels involved throughout the proposed Project activities, and from the presence of WTGs in the operational phase, and lighting. The level of impact from vessels will be based on the vessel type, number, and duration at the location. Each species will be scored for its sensitivity to displacement, based on the available literature for offshore wind farms (e.g. Furness and Wade, 2012; Furness *et al.*, 2013).

The displacement modelling will also be informed by the results of the site-specific surveys, as these will be used to assess the density of species within the proposed Project site (density surface modelling). The survey will be designed to allow for a statistically robust assessment of displacement. In addition to displacement, disturbance at breeding sites will also be assessed. It may also be relevant to use the 'Mrsea' package from Marine Scotland, which can be used by developers to assess displacement effects.

Consideration and assessment of cumulative effects associated with collision and displacement will be made. Where practicable, the cumulative impact assessment will include data and assessments from other reasonably foreseeable plans and projects (such as Project Erebus, the recent Plan-level Habitats Regulations Assessment (HRA) conducted by The Crown Estate concerning extensions to existing offshore wind farms, and potential Round 4 offshore wind farm projects). A list of potential plans and projects and other activities are considered within Section 8.3 of this scoping document.

European marine sites and their designated ornithological features will also be assessed as part of the HRA process. Stage 1 of the HRA process requires the identification of European sites and Ramsar sites relevant to the assessment, and whether the likely impacts of the proposed Project upon the qualifying features of the site, either alone or in-combination with other plans and projects, are likely to be significant (i.e. result in Likely Significant Effect (LSE)). Where LSE is not able to be excluded for designated sites, then Stage 2 of the HRA process (an Appropriate Assessment (AA)) must be undertaken, to inform whether the proposed Project, alone or in-combination, could result in an adverse effect on the integrity of the site, in view of its conservation objectives.

The AA is undertaken by the relevant authority and a Report to Inform an Appropriate Assessment (RiAA) will be provided to support the consent application. Mitigation measures can be taken into consideration during the AA, but not during Stage 1. If an adverse effect on the integrity of a site is determined, then Stage 3 (Assessment of Alternatives) and Stage 4 (Assessment of Imperative Reasons of Overriding Public Interest (IROPI)) will be undertaken.

The aforementioned site-specific surveys, additional data requirements (listed below) and information presented in this EIA scoping document will be used to inform the HRA Stage 1. The survey records will be used to inform the species present in the Study Area. The connectivity of these species to potential protected sites can be determined through known mean max foraging ranges and migratory routes (as discussed briefly here, to be supplemented by additional literature reviews in the HRA), taking into account the seasonality of the species at the site. SNH (2018) guidance on how to apportion the origin of the seabirds to SPAs in the vicinity will be followed. The impacts to be assessed under the HRA will likely follow those identified in the EIA. Table 6.20 summarises the proposed additional data collection for ornithology.

Table 6.20 - Proposed Additional Data Collection for Ornithology

Data requirement	Method	Purpose/Rationale
Desk-based study	Once all of the project description elements of the Project have been finalised (e.g. selection of offshore cable route, cable landfall site, onshore substation location, onshore cable route and onward grid connection) a desk-based study will be carried out to gather up-to-date data for these areas.	This will provide information on which species are present in these areas and the spatial and temporal distribution of species using the site. The findings of the desk-based study will inform the need for further surveys. These data will be used to inform the EIA.

Data requirement	Method	Purpose/Rationale
Offshore bird surveys (Project area of interest and 4 km buffer)	A proposed Bird Survey Specification was submitted to NRW and JNCC in November 2020 to seek agreement on the required works prior to surveys commencing. Digital Aerial Survey (DAS) is the proposed the method of data collection to inform the EIA. It is proposed that the Project site, plus a surrounding 4 km buffer, will be surveyed monthly to gather seabird species abundance and distribution data over a 24-month period from March/April 2021 to Feb/March 2023. Survey data will include species, count, sex (where possible), age (where possible), flight height, flight direction, activity (in flight or on sea surface, rafting/loafing, etc.), position, and date and timestamp.	To provide project-specific baseline site characterisation data for the offshore Project area and surrounding area. This will provide information on which species are present in the area and the spatial and temporal distribution of species using the site. Flight height data will be used in collision risk Modelling. These data will be used to inform the EIA.
Onshore bird surveys	Once the onshore elements of the Project have been finalised (e.g. selection of cable landfall site, substation location, onshore cable route and onward grid connection), the need for further surveys of these areas will be informed by the findings of the desk-based study. Any survey area around the landfall and onshore areas will include a buffer of 100 m. Onshore surveys may also include crepuscular/nocturnal surveys to account for resting birds on passage (particularly in relation to waders), particularly around high tide. Breeding bird surveys may be required for all of the locations of the onshore project infrastructure to provide up-to-date data. The need for winter bird surveys will be considered based on the locations of the project infrastructure and available data. If Angle Bay is selected as the cable landfall option, the Wetland Bird Survey counts (WeBS) will be utilised.	To provide up-to-date project-specific data. These data will be used to inform the EIA.

6.6 Terrestrial Ecology

Table 6.21sets out international and national habitat and species legislation that is used as a framework to identify terrestrial species and habitats of relevance to the proposed Project.

Table 6.21 - Habitat and Species Legislation

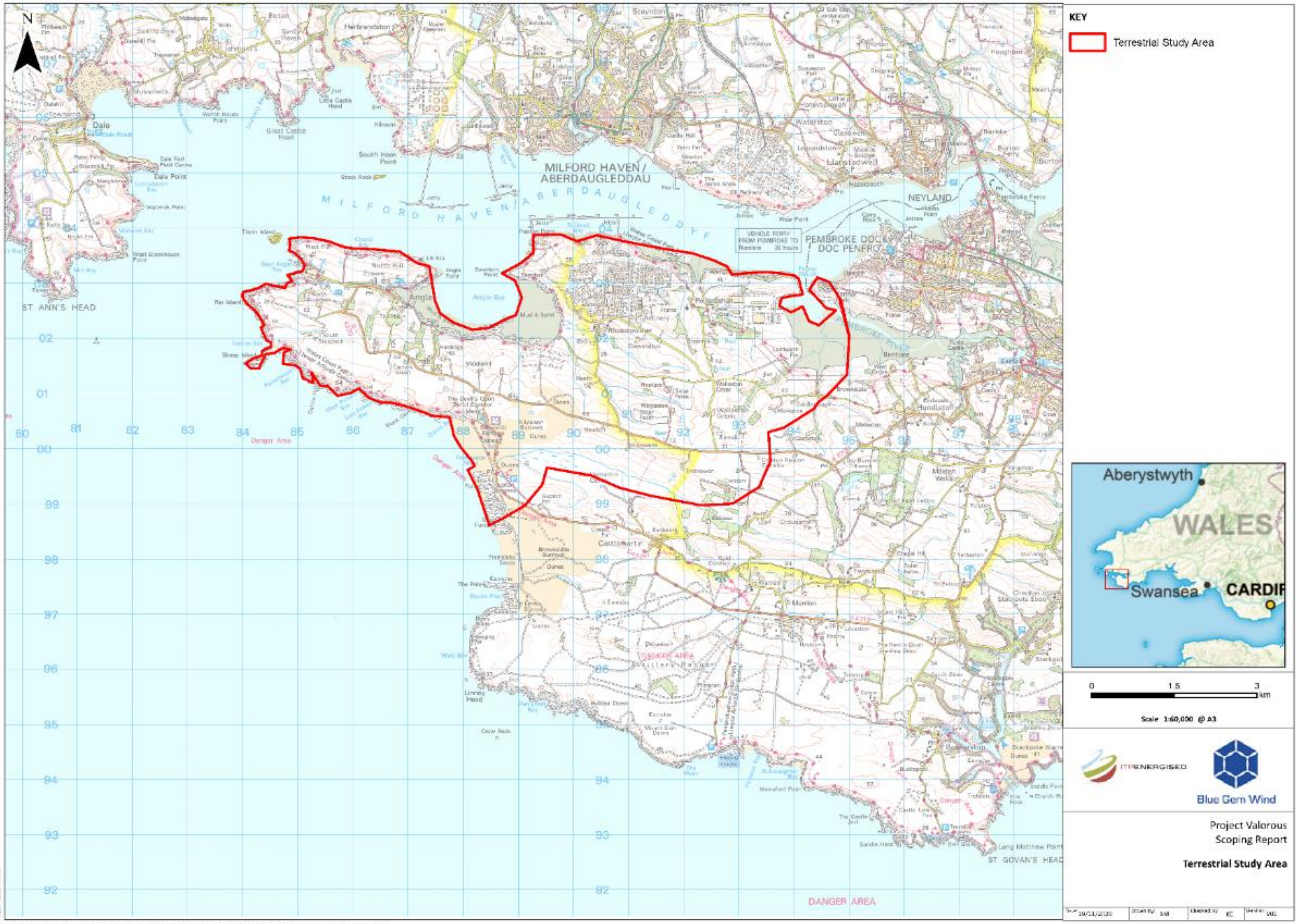
Designation	Definition
International Legislation – EC Habitats Directive[14]	
Annex I Habitat and Annex II Species	Habitats listed in Annex I and Annex II of the EC Habitats Directive are most in need of protection at a European level and for which Special Areas of Conservation (SAC) are designated. A sub-set identifies those which are considered to be 'priority' because they are particularly vulnerable.
Annex IV Species	Species listed in Annex IV of the EC Habitats Directive afforded strict protection independently of their designation under a SAC. These species are recognized as European Protected Species (EPS).
International Legislation – EC Birds Directive	
Annex I Species	Species listed in Annex I of the EC Birds Directive are most in need of protection at a European level and for which Special Protection Areas (SPA) are designated.
National Legislation – Wildlife and Countryside Act 1981 (as amended)	
Schedule 5 Species	Species listed in Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) are notified as receiving protection under Section 9 of the WCA.
Schedule 7 Habitats and Species	Habitat or species listed as being of principal importance in Wales, under Section 7 of the Environment (Wales) Act 2016.
Schedule 8 Species	Plant species listed in Schedule 8 are protected from picking, uprooting or destruction, and from sale.

6.6.1 Study Area

The terrestrial ecology study area is defined in Figure 6.10 and incorporates the majority of the Castlemartin Peninsula. It also extends east as far as Freshwater East and covers an area north of the Cleddau waterway. This area covers a number of potential landfall options for the export cable, potential onshore cable routes from landfall to the proposed substation and potential locations for the onshore substation.

[14] Note that the Directives referenced in Table 6.21are implemented in the UK via the 'Habitats Regulations', which in respect of terrestrial ecology include the Conservation (Natural Habitats, &c.) Regulations 1994 and the Conservation of Habitats and Species Regulations 20017. As a consequence of the UK's exit from the EU, a number of changes were made to the Habitats Regulations to ensure that they remain in force and operable, including the general provisions for the protection of European sites and the procedural requirements to undertake Habitats Regulations Appraisal (HRA).

Figure 6.11 - Extent of the Terrestrial Ecology Study Area



6.6.2 Baseline Data

This assessment is based on a desktop study, with data sourced from publicly available information. The following sources have been reviewed in completing this assessment on terrestrial ecology:

- NRW Terrestrial Phase 1 Habitat Survey – habitat cover data derived from recording undertaken in 1979 and updated in 1991 (Lle, 2019);
- NRW Habitats Network – connectivity mapping available for broadleaved woodland, heathland, unimproved grassland, fens and bogs (NRW, 2019);
- Local Nature Reserves; Ancient Woodland Inventory; Designated Sites; Habitat inventory (data.gov.uk, 2019);
- NBN Atlas (NBN Atlas, 2019);
- Pembrokeshire Wave Demonstration Zone EIA Scoping Report (Wave Hub Ltd, 2018)
- Citations for SAC and SPA designated sites;
- Local Biodiversity Action Plan (Pembrokeshire Biodiversity Partnership, 2011); and
- Biodiversity Assessment Maps (Pembrokeshire Biodiversity Partnership, 2011).

In addition the extended Phase 1 habitat mapping and surveys which have been, and will be, undertaken for Project Erebus will be used to inform the terrestrial ecology assessment. This will be supplemented by further survey effort as required.

6.6.3 Existing Environment

6.6.3.1 *Habitats*

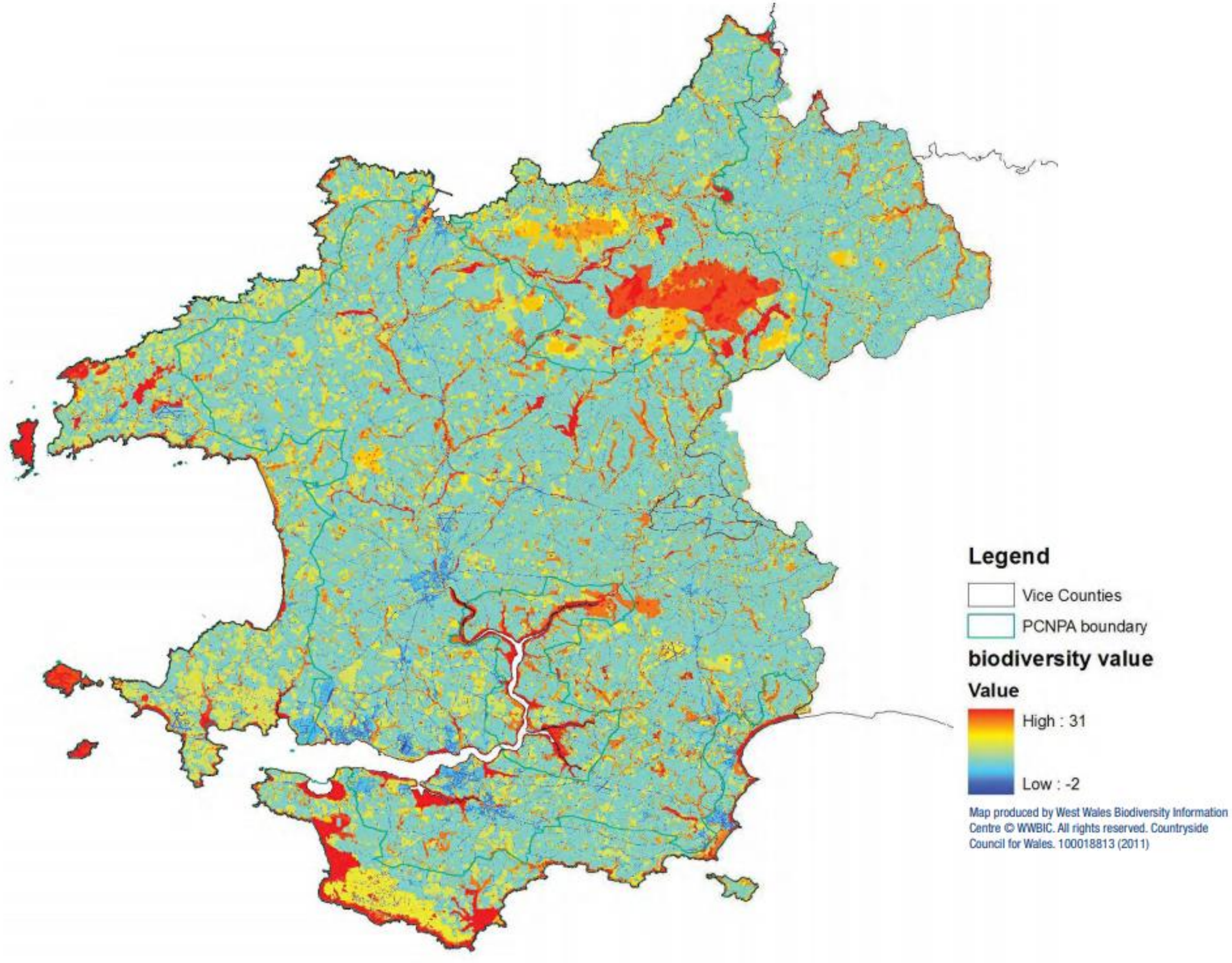
The Castlemartin peninsula is a rich and varied environment with a range of internationally, nationally and locally designated sites, considered further in Section **Error! Reference source not found.** (Designated Sites). Of specific relevance to the proposed Project is the Pembrokeshire Bat Sites and Bosherston Lakes SAC, Limestone Coast of South West Wales SAC, Broomhill Burrows SSSI and Castlemartin Range SSSI as landfall and the onshore cable route may directly cross part of these sites or indirectly affect qualifying mobile features. The preferred onshore substation sites are within 2 km of the Pembrokeshire Marine SAC and Milford Haven Waterway SSSI and 2 km of Somerton Meadows SSSI. It is not anticipated that the development will encroach into these designated sites, although indirect impacts, such as pollution or disturbance may affect the integrity of the sites. The potential impacts on designated sites will be considered further once the Project design is finalised; however, in the absence of a detailed design, a precautionary approach has been applied.

The desktop review has identified the main habitats within the study area, see Table 6.22 below. Additionally, Phase 1 habitat survey work has been undertaken as part of ongoing studies for Project Erebus, and the findings are relevant to Valorous; however, an updated extended Phase 1 habitat survey will be required once the preferred landfall, onshore cable route and onshore substation location have been confirmed to inform further protected species surveys, the potential need for targeted National Vegetation Classification (NVC) botanical survey, identify features of nature conservation interest, and inform the EIA.Figure 6.12 shows biodiversity values across Pembrokeshire and provides an overview of high value sites within the Castlemartin peninsula.

Table 6.22 - Summary of Terrestrial Habitats within the Study Area

Habitat	Qualifying Feature	Protection Status	Importance
Sand dunes; Vegetated sea cliffs and slopes (maritime and dry heath); Calcareous grassland; Ponds and lakes	Yes	Annex I Habitat Section 7 Habitat	International
Neutral unimproved grassland; Semi-natural broadleaved woodland; Wetlands; Improved grassland and cultivated land (field margins); Streams and rivers; Roadside verges	Yes	Section 7 Habitat	National, regional
Industrial / built up	No	None	Negligible

Figure 6.12 - Biodiversity Assessment Map (Pembrokeshire Biodiversity Partnership, 2011)



6.6.3.2 *Species*

The range of terrestrial habitats listed in Section 6.1.3.1 support a diverse and varied range of species, some of which are qualifying features of designated sites and are of international and national importance. Further surveys, informed by the final Project design and layout, and guided by the extended Phase 1 habitat survey results, will be targeted at protected species. These will inform the EIA and allow a thorough assessment of presence and potential impact to be undertaken. However, an overview of key species known to occur in the terrestrial study area is provided in Table 6.23 to represent potential constraints. This list is not exhaustive and is meant as a brief overview only.

Table 6.23 - Summary of Species within the Terrestrial Study Area

Species	Protection Status	Qualifying Feature	Potential Importance
Greater horseshoe bat *Rhinolophus ferrumequinum*; lesser horseshoe bat *Rhinolophus hipposideros*; Otter *Lutra lutra*	Annex II and IV Species Schedule 5 Species	Yes	International
Myotis bat species *Myotis brandti, M. mystacinus, M. bechsteinii;* barbastelle bat *Barbastella barbastellus*	Annex IV Species Schedule 5 Species	No	International
Adder *Vipera berus*	Schedule 5 Species Section 7 Species	No	National
Marsh fritillary butterfly *Euphydryas aurinia*	Annex II Species	Yes	National
Shrill carder bee *Bombus sylvarum*	Section 7 Species	No	National
Petalwort *Petalophyllum ralfsii*	Annex II Species Schedule 8 Species	No	International
Badger *Meles meles*	Schedule 6 Species	No	National

A notable omission from the above list is the hazel dormouse *Muscardinus avellanarius*. There are currently no known records of dormouse on the Castlemartin peninsula and the closest record is at least 10 km beyond the study area’s eastern boundary. However, there is a recent potential dormouse nest record in the area surrounding Pembroke Power Station. Further consultation will be undertaken with the PCNPA and, if required, appropriate assessment will be carried out.

It should also be noted that great crested newts *Triturus cristatus* (GCN) are not present in Pembrokeshire and no records exist within the County. Pembrokeshire falls out with their optimum habitat range and there has been no requirement on larger infrastructure projects to complete GCN surveys.

6.6.4 Identification of Key Sensitives and Potential Impacts

Table 6.24 provides a summary of the potential effects arising from the Project on those habitat and species receptors identified above. This is to be further defined once landfall, cable route, and the substation location has been confirmed; however, at this stage a precautionary approach has been applied and impacts scoped in or out on this basis. It has been assumed that the onshore cable route would be left *in situ* as and when the Project is decommissioned, to avoid any unnecessary disturbance or harm.

6.6.5 Potential Mitigation

The initial focus of mitigation on terrestrial ecological features for the proposed Project will be to design out any impact through careful siting to avoid vulnerable habitats and species. The use of construction techniques that result in the least disturbance and damage, and phasing development so as to avoid the most sensitive times of the year for species and habitats, will also be key measures. Where these initial mitigation measures are not possible, as part of the detailed design process, specific mitigation and, where necessary, enhancement will be developed and discussed with the relevant stakeholders, for example NRW or the LPA.

Notwithstanding the above, the following approach will be adopted to ensure decisions are based on the best available information, and the most appropriate mitigation is proposed:

- Detailed surveys will be programmed in, to be undertaken by qualified, experienced and, where necessary, licensed ecologists, and in accordance with published guidance where this exists, and best practice;
- The results of the survey work will inform the final design and siting, to design out adverse impacts, and consideration will be given to construction techniques and phasing. For example, if horizontal directional drilling (HDD) cannot be used under hedgebanks, methods such as the translocation of sections will be proposed to allow the retention of the seed base and a quicker regrowth; and
- Operational mitigation will also be considered, for example using intelligent technology for the lighting of the substation and potential access road; planting schemes; and monitoring.

Table 6.24 - Potential Effects and Rationale for Scoping for Terrestrial Ecology

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Habitats				
Sand dunes	Direct disturbance and loss of habitat within the dune system due to the installation / decommissioning of onshore cable route and associated working areas.	Construction	Yes	Both areas of dunes within the study area are designated features, part of the SAC and SSSI, and further information on landfall and construction method is required before understanding the significance of impact.
Vegetated sea cliffs and slopes (maritime and dry heath)	Damage, disturbance and loss of cliffs, grassland and associated species through the installation of onshore cable and disturbance from working areas.	Construction	Yes	The cliffs and maritime grassland are sensitive to disturbance, and slow to recover, so any level of disturbance may be considered significant. These habitats are features of the SAC and SSSI and further assessment is required.
Calcareous grassland	The overland installation of the onshore cable from landfall may disturb, damage or result in the loss of areas of grassland.	Construction	Yes	Large areas of grassland may be affected depending on the final route. Due to the sensitive nature of this habitat and protected status further assessment is required.
Neutral unimproved grassland	Installation of the onshore cable route may result in the direct disturbance, damage or loss of areas of grassland. Lay down areas of associated works may also cause harm.	Construction	Yes	The cable route from landfall may result in a significant effect on this SSSI feature. Due to the sensitivity of this habitat further information is required to assess impacts.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Semi-natural broadleaved woodland	Significant disturbance, damage and loss may occur as a result of the installation or decommission of the onshore cable route through an area of woodland. Damage from lay down areas or associated works may also occur.	Construction	Yes	If the route or areas disturbed by landfall coincide with areas of woodland it is likely to result in significant impacts which require further assessment once the scheme is finalised.
Ponds and lakes	No direct effect expected on ponds or lakes, although disturbance or damage to associated habitats may arise from excavations and installation of onshore cable route. Pollution incidences may also occur on connected watercourses.	Construction	Yes	Although no ponds or lakes have been identified at the potential landfall sites, onshore cable routes would seek to avoid lake or pond features. Further information is required prior to scoping out any significant effect.
Streams and rivers	Direct disturbance and damage to streams, rivers and associated habitats may arise during the installation of the onshore cable or, indirectly, from work on hydrologically connected habitats.	Construction	Yes	Watercourses and associated habitats and species are vulnerable to disturbance and damage, sometimes taking a long time to recover. Further detailed assessment is required to establish the significance of any effect.
Wetlands	No direct impacts are expected to areas of wetland, however indirect impacts such as pollution incidences may occur on connected watercourses.	Construction	Yes	No areas of wetland are expected to be directly affected, however a final assessment will be undertaken once the final route is confirmed.
Improved grassland (pasture)	Excavation of the onshore cable route is likely to directly disturb improved grassland and associated habitats such as field margins. Field margins may be	Construction	Yes	Improved grassland is of negligible value, however associated habitats such as field margins are of intrinsic value at a local and regional level and further assessment is required.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
	severed or temporarily damaged depending on construction method.			
Cultivated land	Excavation of the onshore cable route is likely to directly disturb cultivated land and associated habitats such as field margins. Field margins may be severed or temporarily damaged depending on construction method.	Construction	Yes	Cultivated land is of negligible value, however associated habitats such as field margins are of intrinsic value at a local and regional level and further assessment is required.
Roadside verges	Disturbance, severance, or temporary loss arising from the installation of the onshore cable route, will direct affect roadside verges. Damage may also be caused in accessing sites during construction.	Construction	Yes	Roadside verges are a valuable habitat and severance of the verge network may result in significant impacts if this feature is the only means of connectivity through the area. Further assessment is required once final route and construction methodology is known.
Species				
Greater and lesser horseshoe bats	It is not expected that roost sites will be directed impacted; however, should cable installation run close to bunkers or caves, indirect disturbance may occur. Direct and indirect impacts will affect foraging and commuting bats during all phases of the Project. These relate to severance of connectivity to habitat features such as hedgerows and woodland from the cable installation; temporary disturbance or loss of foraging habitat as a result of cable installation; and increased noise, light and	Construction Operational Decommissioning	Yes	Both species are features of the SAC and exceptionally vulnerable to severance of connectivity and disturbance from noise and light. Detailed assessment will be required once the onshore cable route and onshore substation location have been finalised, to understand the significance of effect.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
	vibration from construction, decommissioning and during the operation of the substation.			
Myotis bat species	As above	Construction Operational Decommissioning	Yes	Although not features of the SAC, these species are Annex IV species vulnerable to severance of connectivity and disturbance from noise and light. Detailed assessment will be required once the onshore cable route and onshore substation location have been finalised, to understand the significance of effect.
Barbastelle bat	As above	Construction Operational Decommissioning	Yes	As above
Otter	Disturbance or damage to habitats supporting resting or breeding otters may occur at landfall sites and along the cable route. There is a risk of pollution incidences on hydrologically connected features affecting foraging otters, and also an increase in noise, lighting, and vibration during construction, operation and decommission.	Construction Operational Decommissioning	Yes	Otters are an SAC feature and vulnerable to habitat fragmentation, loss of connectivity and pollution. Depending on the final landfall, onshore cable route, and onshore substation, the effects of the Project may be significant. Further assessment will be required.
Dormouse	Disturbance to habitat, severance of connectivity and a loss of foraging habitat may occur as a result of cable route or the substation siting.	Construction Operational Decommissioning	No	There are no records of dormice in the study area and limited suitable habitats, with the closest record 10 km from the site. Subject to further consultation regarding a reported possible dormouse nest near Pembroke Power Station, however impact is anticipated.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Adder	Adders are sensitive to habitat fragmentation and disturbance and the installation of the onshore cable route may disturb suitable habitats. Impacts may also arise at landfall sites and associated construction lay down areas.	Construction	Yes	Due to the potential cable route crossing valuable adder habitat, further assessment is required to understand the significance of the potential impact.
Great crested newt	Disturbance to habitat, severance of connectivity, and a loss of foraging habitat may occur as a result of cable route or the substation siting.	Construction Operational Decommissioning	No	There are no records of great crested newt in Pembrokeshire, and limited suitable habitats, therefore no impact is anticipated.
Marsh fritillary butterfly	Breeding habitat may be disturbed or lost during the installation of the cable route or from associated construction lay down areas.	Construction	Yes	Certain areas support marsh fritillary and until the final landfall and cable route are defined, it will not be possible to assess the significance of effect.
Shrill carder bee	Excavations and associated works from the onshore cable route may disturb and destroy habitat supporting the shrill carder bee resulting in mortality or loss of feeding areas.	Construction	Yes	Shrill carder bee are exceptionally vulnerable to habitat loss and any disturbance may be considered significant. Further assessment is required once the onshore cable route / location of the onshore substation is finalised.
Petalwort	Excavations and associated works from landfall and the onshore cable route may disturb and destroy the dune habitat resulting in a loss of plants or habitat quality.	Construction	Yes	Petalwort are vulnerable to habitat loss, and disturbance may be significant. Further assessment is required once landfall and the onshore cable route / location of the onshore substation is finalised.
Badger	Disturbance to habitat, severance of connectivity and a loss of foraging habitat	Construction Operational Decommissioning	Yes	Badger are vulnerable to habitat loss and disturbance may be significant. Detailed assessment will be required once the onshore cable route and onshore substation

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
	may occur as a result of cable route or the substation siting.			location have been finalised, to understand the significance of effect.

6.6.6 Proposed Approach to Environmental Assessment

The formal Scoping Opinion issued by NRW will inform the approach to the environmental assessment and it is anticipated that further discussions will be held with the relevant stakeholders, NRW and the LPAs, to confirm the scope and schedule of any terrestrial ecology surveys. The continued development of the proposed Project design envelope will further inform the approach to EIA as impacts and receptors are confirmed when the precise nature and locations of the development are fixed. The approach will be iterative and NRW will be kept informed with progress via regular meetings throughout the EIA process.

The following surveys (Table 6.25) are proposed to inform the terrestrial ecology aspect of the EIA.

Table 6.25 - Proposed Terrestrial Ecology Surveys to Inform the EIA

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Extended Phase 1 survey	Updated survey to extend from landfall, along the preferred onshore cable route, at the proposed substation location (including areas for laydown), and for the route from the substation to Pembroke Power Station.	Spring / summer 2021	To provide a record of habitats and ecological features across the onshore Project area and determine the need for any protected species surveys or more detailed habitat surveys.
National Vegetation Classification (NVC) botanical survey	As above, if required based on Phase 1 survey findings and preferred infrastructure locations/ route	Spring / summer 2022/2023	To focus on types, location, and quality of plant species that may be affected by the proposed development.
Bat surveys	Further discussions will be held with NRW and the LPAs to agree the scope of the surveys.	It is anticipated these may commence spring 2022.	Surveys will be required to identify foraging areas, important connectivity, and potentially new roosts sites to enable the final design to avoid these areas or propose construction methods that will reduce harm e.g. HDD under hedgerows to avoid severance of connectivity.
Otter surveys	The surveys will focus on landfall, where the onshore cable route crosses watercourses or associated habitats, and where biological data (for example otter road causalities) record otter presence within the boundary of the proposed development.	It is anticipated these may commence spring 2022.	Surveys will be required to identify foraging areas, breeding and resting sites, to enable the final design to avoid these areas or propose construction methods that will reduce harm.
Badger surveys	The extended Phase 1 survey will identify areas of badger activity, and badger surveys will focus on these	Autumn/ winter 2022	To identify the location of active badger setts and areas of activity including foraging. This will inform site layout or

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
			establish the requirement for a licence.
Reptiles surveys	The extended Phase 1 survey will identify areas of suitable reptile habitat and presence. Discussions will be held with NRW and the LPA on implementing a Reptile Mitigation Strategy for medium and low risk areas.	Spring 2022	To identify areas of reptile suitability and inform the development of a Reptile Mitigation Strategy.
Amphibian and invertebrate surveys	Depending on findings of the extended Phase 1 survey, amphibian and invertebrates surveys may be required.	2022	To inform the Project design.
Dormouse surveys	Due to the evidence provided above, it is not the intention of BGW to undertake dormouse surveys, being unreasonable and disproportionate to the likely impact, unless evidence of presence has recently been established.	N/A	N/A
Great crested newt surveys	Due to the evidence provided above it is not the intention of BGW to undertake great crested newt surveys, being unreasonable and disproportionate to the likely impact, unless evidence of presence has recently been established.	N/A	N/A

The results of these surveys, along with additional desk-based data collation and feedback from consultation with key stakeholders, will be used to inform the detailed impact assessments for each species and habitat present in the Study Area. The impact assessments for terrestrial ecology will be conducted in accordance with the Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater and Coastal (CIEEM, 2018). Appropriate mitigation and conservation proposals (including any long-term management that may be required), as well as monitoring proposals, will be set out within the final ES.

Sufficient information will be presented to allow the Competent Authority to undertake an appropriate assessment under Regulation 61 of the Conservation of Habitats and Species Regulations 2017. Consideration will also be given on how the proposal will meet the 3 tests as set out in Regulation 57 of the Conservation of Habitats and Species Regulations 2017. The EIA will also identify where further licenses may be required (e.g. European Protected Species Licences).

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7 Human Environment

7.1 Commercial Fisheries

7.1.1 Study Area

The Study Area, including the proposed offshore array area, export cable routes and landfall, lies within the International Council for the Exploration of the Sea (ICES) Statistical Rectangles 32E4 and 31E4. Whilst information presented in this section relates to the wider Celtic Sea region, and official fisheries data from these ICES rectangles will be used to inform the environmental assessment on commercial fishing receptors, such data may under-represent the smaller, inshore fishing fleet (<10 m). Therefore, it is proposed that other available, smaller-scale studies will also be used, alongside consultation with local fishing organisations and fleets of south Wales, the Severn, north Devon and Cornwall, as well as non-UK fleets that fish this region.

7.1.2 Baseline Data

This desk-based summary has identified the following available datasets which are of relevance to the Study Area and will be analysed further as part of any environmental assessment:

- Marine Management Organisation (MMO) UK fleet landings by selected ICES Rectangle;
- MMO UK and foreign fleet landings into the UK by port;
- Welsh Government, Marine Planning Portal, Natural Resources Wales (NRW);
- European Commission, Scientific, Technical and Economic Committee for Fisheries (STECF) non-UK landings by ICES Rectangles;
- MMO Vessel Monitoring System (VMS) fishing activity data for UK vessels >15 m;
- MMO Marine Information System;
- Project Erebus EIA Scoping Report (MarineSpace, 2019);
- Commercial fisheries activity report from the Greenlink Interconnector Environmental Report (Greenlink, 2019); and
- ICES spatial data on fishing intensity for EU vessels.

To support these existing datasets and ensure that the inshore (<10 m) fishing fleet is represented, the following regional fisheries organisations have also been identified and will be approached for engagement throughout the EIA. Outputs from this engagement will be used to inform final site selection and also to develop further understanding of existing fishing activity in the Study Area.

- West Wales Shell Fisherman’s Association (WWSFA);
- Welsh Fishermen’s Association (WFA);
- South and West Wales Fishing Communities (SWWFC);
- Devon and Severn IFCA (D&SIFCA);
- North Devon Fishermen’s Association (NDFA);
- Cornwall Fish Producers Organisation (CFPO);
- Interfish Ltd;
- Western Fish Producers Organisation (WFPO);
- South West Fish Producers Organisation (SWFPO);
- South West Ireland Fish Producers Organisation (SWIFPO);
- South East Ireland Fish Producers Organisation (SEIFPO); and

- A number of representative bodies of non-UK fleet, including trawler agents of the Belgium and Anglo-Spanish fleet based in Milford Haven.

7.1.3 Existing Baseline

Commercial fishing is widely distributed in the Celtic Sea, and from data and information detailed above it has been identified that the offshore part of the Study Area (array) is utilised by both UK and non-UK (Irish, French, Belgian) commercial fishing vessels. The inshore part of the Study Area (export cable and landfall), off the coast of Pembrokeshire, is known to be important for potting/netting by the local, inshore fishing fleet.

The closest large fishing port to the Study Area is the Port of Milford Haven. Based on the November 2020 UK fishing vessel list issued by the MMO, there were 45 <10m vessels registered at Milford Haven and 12 >10m vessels.

In 2017, 500 tonnes of demersal fish and 1,000 tonnes of shellfish were landed into Milford Haven, representing values of £1.5 million and £2 million respectively.

Fisheries within the Celtic Sea region are managed through the EU Common Fisheries Policy (CFP) with fisheries of some stocks managed by the North East Atlantic Fisheries Commission and by coastal state agreements.

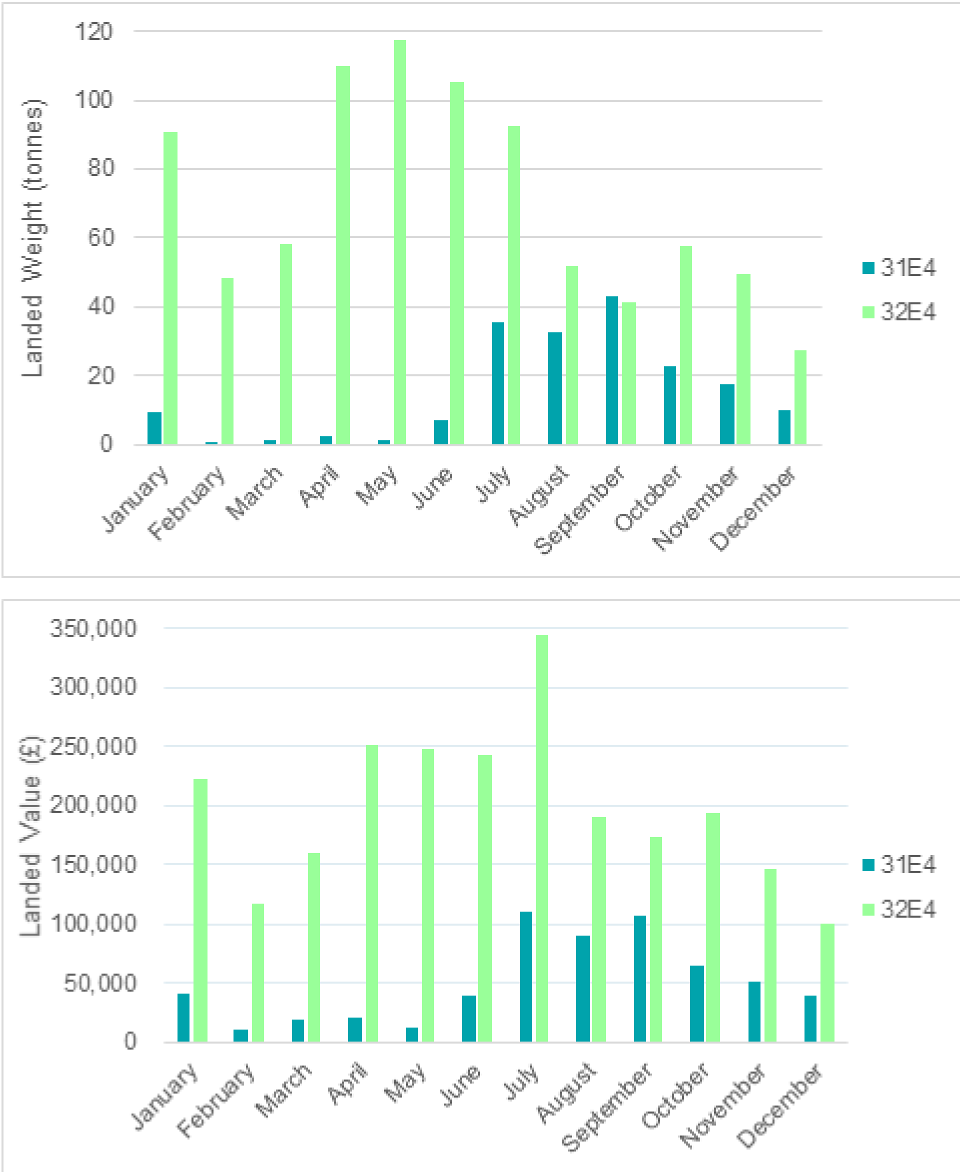
At the time of writing, uncertainty still exists with regard to the framework within whichcommercial fishing activity in UK waters will take place post 31 December 2020, i.e. end of the Brexit transition period.

7.1.3.1 *Value of Landings and Effort*

In terms of landed weight and value, demersal and shellfish species are most prevalent within and around the Study Area. Based on MMO fisheries data for 2019, the weight and value of landings by all vessels from ICES rectangle 32E4 (export cables and landfall) was over 1,000 tonnes of fish (all species) with a value of nearly £3 million. Of this value, £1.6 million was landed by <10 m vessels. Over £2.8 million of the total value was made up by shellfish landings (Figure 7.1). These data highlight the importance of the Welsh inshore static gear (potting) fishery in the Study Area.

Landings from ICES rectangle 31E4 (offshore array area) were also dominated by shellfish, caught using both mobile (beam trawls, demersal trawls / seine) and static methods (pots and traps and drift / fixed nets). Based on MMO fisheries data for 2019, the weight and value of landings by all vessels from ICES rectangle 31E4 was just over 180 tonnes of fish (all species) with a value of just over £600,000. Significantly higher landings were recorded for ICES rectangle 32E4, suggesting that the proposed array site lies in an area of relatively lower commercial fishing activity, compared with the inshore region.

Figure 7.1 - Total Landed Weight (Tonnes) and Value (£) in 2019 from ICES Rectangles 31E4 and 32E4 by All Vessels (Source: MMO, 2020)



7.1.3.2 *Fishing Vessels, Fishing Grounds and Target Species*

Shellfish Species

The shellfish industry in south Wales is now considered to be of the greatest local economic importance in terms of commercial fishing activity. There are valuable potting grounds for crab, lobster and whelk around the Pembrokeshire coast. With the exception of larger vessels working out of Milford Haven, most fishing off the southwest coast of Wales occurs close inshore, with very few boats working outside 6 miles. Since 1995, a significant whelk fishery has developed in Carmarthen Bay and offshore of the Gower, Fishguard and Milford Haven.

Warmer months see a peak in crab and lobster potting activities, while the whelk fishery is dominant through the winter with 1,000–2,000 pots being set per vessel. Pots are also set for prawns in parts of the north Pembrokeshire coast and there is some limited potting for green crab in Milford Haven. Several local and (mainly) Scottish visiting boats dredge for scallops in

Cardigan Bay (further north than the Study Area), particularly in winter, landing into Fishguard and Milford Haven, and trawlers target native oysters in winter in Swansea Bay and Milford Haven.

Demersal Species

Key demersal target species landed from within the Study Area include sole, blonde ray, bass, pollack, monks or anglers, thornback ray and plaice. Flatfish and rays (principally thornback) are taken in fixed nets and otter and beam trawls from spring through to the end of the year. Gill nets and otter trawls target cod and whiting during the colder months. Large-meshed tangle nets are used for rays and large flatfish such as turbot.

The trawler fleet concentrates its efforts in the Bristol Channel and Cardigan Bay and lands a mixed catch throughout the year. These trawlers (mostly <10 m) fish mainly inshore, and the sole fishery attracts visiting beam trawlers from the south coast of Devon, Cornwall and Belgium.

Pelagic Species

Pelagic fish landings from this area are mainly of mackerel, and of relatively lower economic importance compared with demersal and shellfish species.

Non-UK Vessels

International vessels fish waters in and around the Study Area, most commonly from Ireland, France and Belgium. A summary of STECF data showed that the key species landed by the Irish, French and Belgian fleets in the vicinity of the Study Area were European sprat, great Atlantic scallop, edible crab, ray / skate, haddock, anglerfish, whiting, sole, megrim and thornback and blonde ray.

7.1.3.3 Intertidal Commercial Fishing Activity

The intertidal regions of the Pembrokeshire coast are recognised for harvesting cockles, mussels, Pacific and native oysters, clams and razor shell. There could, potentially, be a conflict with existing intertidal fishing activities and intertidal regions of the proposed export cable and landfall locations.

7.1.4 Identification of Key Sensitivities and Potential Impacts

Table 7.1 - Key Sensitivities and Potential Impacts to the Commercial Fisheries Receptors in the Study Area.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Commercial Fisheries	Loss / damage to fishing grounds (long term) due to presence of floating turbine anchors / cable protection (and associated reduction in revenue).	Construction Operational Decommissioning	Yes	Data have shown the offshore (array) part of the Study Area to be of lower importance in terms of landed weight and value than inshore regions, however, this area still represents a commonly used fishing ground by both UK and non-UK vessels.
Commercial Fisheries	Loss / damage to fishing grounds (long term) due to presence of cable (export) protection.	Construction Operational Decommissioning	Yes	Data have shown the inshore part of the Study Area to be an important region for commercial fishing. The final offshore cable route selected may pass close to / through inshore reef features which are known to represent important habitat for bass – a key target species for commercial and recreational fishermen.
Commercial Fisheries	Restricted access to / displacement from fishing grounds (long term).	Construction Operational Decommissioning	Yes	Vessels may be restricted from accessing usual fishing grounds due to statutory exclusions, safety zones or avoidance of the area by fishing vessels due to safety reasons.
Commercial Fisheries	Reduction in water depth.	Construction Operational Decommissioning	Yes	Fishing activity may be displaced, or loss of grounds may occur due to safety, if a reduction in water depth results from installation of project infrastructure.
Commercial Fisheries	Contamination of fish stocks.	Construction Operational Decommissioning	Yes	Installation methods may result in sediment plumes and increased suspended sediment which

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
				may in turn impact upon fish stocks and water quality.
Commercial Fisheries	Snagging resulting from seabed obstruction.	Construction Operational Decommissioning	Yes	Fishing activity may be displaced, or loss of grounds may occur due to safety, if a seabed obstruction exists.
Intertidal Commercial Fisheries	Restricted access to / displacement from fishing grounds (temporary).	Construction Operational Decommissioning	Yes	Data has shown the inshore Study Area to be an important region for commercial fishing.

7.1.5 Potential Mitigation

Potential impacts, detailed in Table 7.1, that may arise from the development of the proposed Project could be mitigated via the following measures:

- Good communication and regular engagement with the commercial fishing community through a dedicated project Fisheries Liaison Officer (FLO);
- Use of Safety Zones around installation vessels during construction and major maintenance works;
- Potential development of a Community Fisheries Fund to explore mechanisms to support local fishing industries if/when FLOW projects develop in this region;
- Ensuring all subsea cables are buried to suitable depths to avoid interaction with fishing gear. Where burial is not possible, due to ground conditions, ensuring appropriate cable protection is deployed and clearly marked on relevant charts;
- Development of agreed transit routes for construction vessels to avoid damage to static gear; and
- Clearly marking the development site and project infrastructure.

Any specific mitigation measures would be discussed and proposed during the EIA phase and would be agreed with the regulatory authority and relevant fishing representatives.

7.1.6 Proposed Approach to Environmental Assessment

The approach to assessing the impacts of the proposed Project on commercial fishing receptors will include further data collection and engagement as outlined below:

- Detailed desk-based fisheries assessment to identify key fishing grounds, seasons, and techniques – using ICES data supplemented with other studies, data, and reports from the region, as detailed in Section 7.1.2; and
- Consultation – meetings with fisheries organisations, representatives and stakeholders including;
  - WWSFA;
  - WFA;
  - SWWFC;
  - D&SIFCA;
  - NDFA;
  - National Federation of Fisherman's Organisations (NFFO);
  - Welsh Marine Fisheries Advisory Group (WMFAG);
  - Welsh Government Fisheries Officer, Milford Haven;
  - Cornish Fish Producers Association (CFPO);
  - South West Fish Producers Organisation (SWFPO);
  - Interfish Ltd;
  - Western Fish Producers Organisation (WFPO);
  - South West Ireland Fish Producers Organisation (SWIFPO);
  - South East Ireland Fish Producers Organisation (SEIFPO); and
  - A number of representative bodies of non-UK fleet, including trawler agents of the Belgium and Anglo-Spanish fleet based in Milford Haven.

Both formal data and reports, as well as local knowledge, will be used to understand commercial fishing activity with the Study Area and to fully assess both direct and indirect impacts during the installation, operation and decommissioning phases. Due to differing characteristics, such as sensitivity to types of impacts, recoverability etc., specific receptor groups will be defined and potential impacts on these groups will be assessed. As way of example, one receptor group may be <10 m inshore potting vessels, whilst another may be

>10 m non-UK vessels fishing outside 6 nm. This approach will ensure all key potential impacts are properly assessed.

Where appropriate, mitigation measures will be proposed and residual impacts then presented.

Other than the detailed consultation outlined above, no specific surveys of commercial fisheries activity are proposed during the EIA stage.

7.2 Shipping and Navigation

7.2.1 Study Area

The Study Area encompasses the marine and coastal activities within a search area of approximately 20 km radius around the proposed offshore array area and also within 5 km either side of the possible export cable routes and landfall locations.

7.2.2 Baseline Data

This chapter presents an overview of the baseline environment, based on a high-level review of available data sources. A detailed baseline assessment would be proposed as part of the Navigation Risk Assessment (NRA) and ES.

Navigational Features

The navigational features baseline has been established following a review of:

- Admiralty Charts of various dates;
- Royal Yacht Association (RYA) UK Coastal Atlas of Recreational Boating 2019;
- Shipping Vessel Density (EMODnet 2020);
- Data from 2 x 14-day Project Erebus marine traffic surveys undertaken August and November 2020; and
- Marine Character Areas – MCA 23 – South Pembrokeshire Open Waters, NRW 2015.

Marine Traffic

Detailed marine traffic baseline data will be established via marine traffic surveys undertaken as part of the NRA process – see Table 7.3. The Maritime Coastguard Agency (MCA) will be engaged with throughout the EIA for advice, along with other stakeholders such as Trinity House Lighthouse Service (THLS).

7.2.3 Baseline Environment

Navigational Features

The key navigational features in the vicinity of the proposed Study Area are established shipping channels as shown in Figure 7.2 but it should be noted that the proposed Project area has been selected to avoid major shipping lanes in the region. The principal navigation route for vessels transiting north to south in this region is located to the west of the proposed array site boundary, with the “Off Smalls” north south Traffic Separation System (TSS), located approximately 16 nm north northeast of the proposed Project area. For vessels transiting east to west, vessels pass predominantly to the north.

Closer inshore, the principal navigation route for vessels transiting east to west (located to the northeast of the proposed Project Area) contains the convergence of the shipping lanes heading for Milford Haven and also includes vessel transiting to and from the Celtic Sea and in and out of Milford Haven and the English Channel. All the aforementioned navigation routes are used by large cargo vessels, tankers, and ferries; but also smaller craft such as fishing vessels and recreational boats. The exact marine export cable corridor is not yet known, however, it will most likely pass across one or both of these navigation routes.

For the proposed landfall options (Freshwater West, West Angle Bay and Angle Bay (Sawdern Point) and Angle Peninsula South Coast), the marine export cable route will enter, or be in close vicinity of the vessel approach to Milford Haven. Milford Haven is the fifth largest port in the UK. The Milford Haven Port Authority (MHPA) provides port, harbour and associated services, as well as servicing the navigational needs of the 3 major oil refineries in the Haven. Milford Haven Waterway also contains a passenger ferry service. Annually, the Milford Haven ferry terminal handles 62,000 Ro-Ro units and 325,000 passengers for Irish Ferries (MHPA, 2017). A twice daily ferry service runs from Pembroke Dock ferry terminal to Rosslare, Southern Ireland. There are informal anchorages present in proximity to the possible export cable route, principally for vessels waiting to dock at Milford Haven.

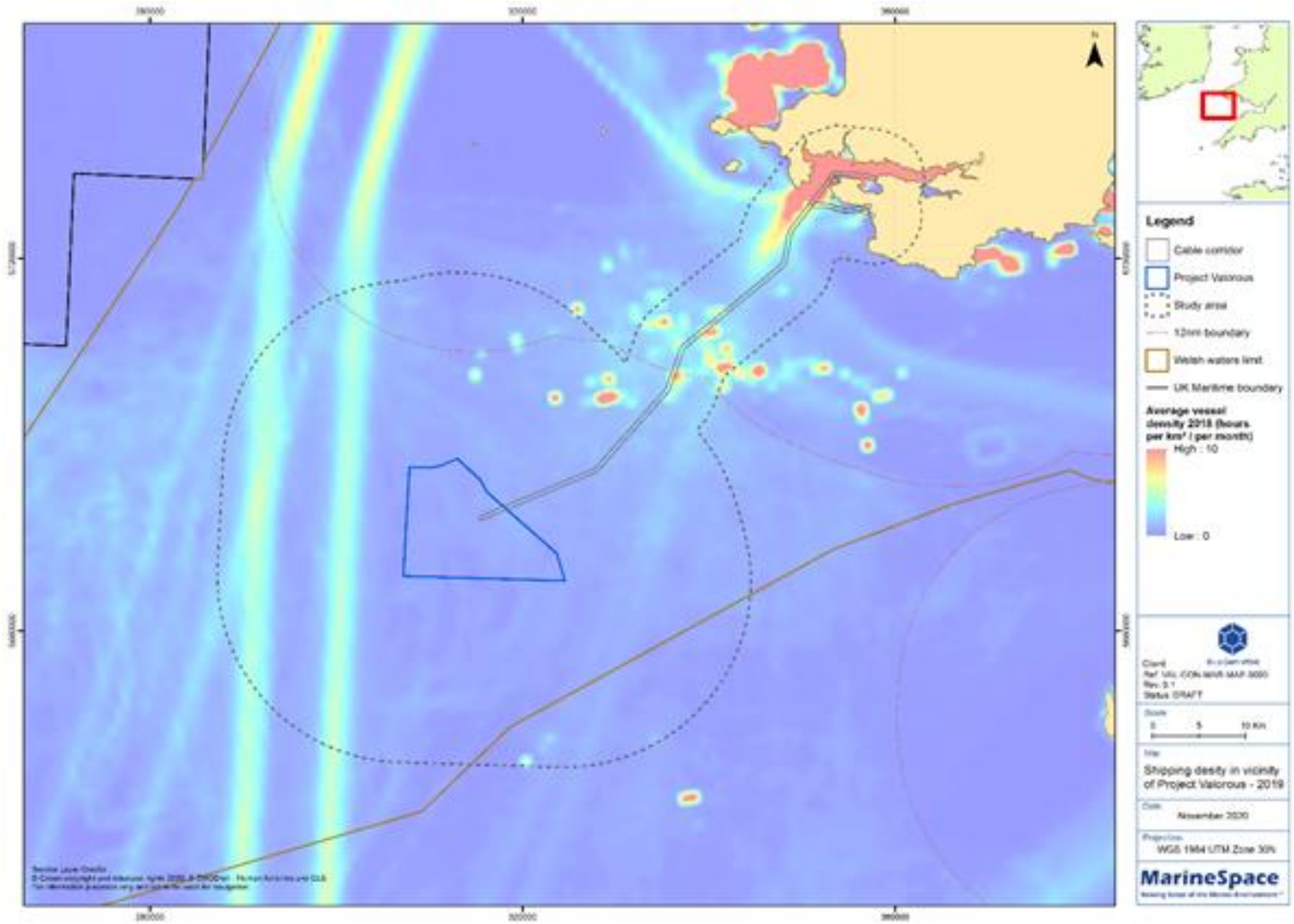
A number of harbours, quays and marinas also exist in this region which are used by recreational vessel traffic in the vicinity of the proposed Project Area. These recreational vessels may also use the navigational channels to the northeast, along the proposed export cable route area, and a small number may be present within the wider proposed Project Area, although the number and frequency decreases towards the proposed Project Area. The harbours, quays and marinas in the vicinity of the proposed Project Area, cable routes and landfalls include: Milford Haven Marina, Neyland Yacht Haven, Stackpole Quay and Tenby.

Sailing and motor cruising are popular activities in this region with sailing clubs and facilities to launch motor vessels located along the coast. Due to Ministry of Defence (MoD) restrictions, there are no formal anchorages along this part of the south coast although Freshwater Bay and Barafundle Bay traditionally provide sheltered anchorages for vessels passing through these waters.

7.2.4 Identification of Key Sensitivities and Potential Impacts

Table 7.2 below summarises the potential impacts of the proposed Project on navigational receptors identified as part of the baseline assessment. However, it should be noted that a full baseline assessment, as part of the NRA, may identify additional impacts on receptors that could not have been identified using the data considered within this Scoping Report.

Figure 7.2 - Estimated Annual Density of all Vessel Transits 2019 (EMODnet, 2019)



7.2.5 Potential Mitigation

Potential mitigation measures that could be applied to reduce impacts on shipping and navigation receptors are outlined below. Development of these measures to make them specific to the proposed Project will occur via the formal NRA process and will be presented in the final ES. All construction, operational and maintenance operations are to be fully compliant with legislation, guidance and best practice as well as in accordance with up to date written procedures, e.g. MCA Guidance on Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response MGN 543 (it is noted that MGN543 is expected to be revised in early 2021).

- Promulgation of information to local stakeholders through local Notices to Mariners (NTM) and other appropriate Maritime Safety Information (MSI) dissemination methods. Rolling and regular updates during construction phases. Planning and coordination between developer and vessel operators. Selection of suitable installation and maintenance vessels and ensuring all personnel are trained and competent persons. Use of appropriate Personal Protective Equipment (PPE) by personnel;
- GPS off station alarm / SCADA (Supervisory Control and Data Acquisition) monitoring system;
- Mooring arrangements, including redundant mooring (up to 5 in total) for the floating turbines will be carried out in accordance with the MCA and HSE Guidance '*Regulatory expectations on moorings for floating wind and marine devices*', which also include Third Party Verification;
- Incidents and near misses will be reported and investigated by developer and operators;
- Incidents to be reported to the MAIB in accordance with MGN 564: Marine Casualty and Marine Incident Reporting;
- All offshore infrastructure, and the site boundaries, to be marked in accordance with Trinity House requirements; Devices to be marked in accordance with MGN 543 and to comply with IALA standards;
- Once operational, the entire site and cable route should be surveyed and charted as required by UKHO and International Hydrographic Organisation (IHO). Changes to charted depth arising from wind turbines and associated moorings, and the burial depth of cabling, should be surveyed and marked on navigational charts;
- Formulation and implementation of an Emergency Response Co-operation Plan (ERCoP);
  - Including an assessment of the impact of, and emergency response to, a turbine breaking free of its moorings, along with appropriate risk mitigation measures;
- Passage plans for construction and maintenance craft;
- Safety zones (construction and O&M phases only) of appropriate configuration, extent and application to specified vessels;
- Marine Traffic Control for project vessels during construction;
- Co-ordination Centre from construction phase onwards;
- Appropriate cable burial depth will be determined and applied, as far as possible, via a Cable Burial Risk Assessment using the Carbon Trust methodology (Carbon Trust, 2015);
- Subject to marine traffic volumes, an anchor penetration study may also be necessary prior to construction commencing;
- Inter-array and export cable protection where burial to appropriate depth not possible (without leading to >5% reduction in navigable water depths);
- Minimum clearance of turbine rotor blade tip above Mean High Water Springs; and
- Vessel nomination as guard vessel during construction / decommissioning activities.

Table 7.2 - Key Sensitivities and Potential Impacts for Shipping and Navigation

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Recreational and commercial vessels	Interaction of Project vessels with commercial, fishing and recreational vessels.	Construction Operational Decommissioning	Yes	During the construction/decommissioning phase, the presence of installation vessels undertaking construction activities within the offshore Project Area has the potential to interfere with other marine users. During the operational phase, work boats within the Project Area may impact on other marine users. The significance of impact will be dependent on the construction port and selected landfall / cable route.
Recreational and commercial vessels	Impacts on vessel routes.	Construction Decommissioning	Yes	There are no transit routes currently passing through the offshore site which are likely to be displaced. However, there are transit routes running across the proposed export cable area which are likely to be displaced during the construction and decommissioning phases of the project including displacement due to avoidance of the area by vessels for safety reasons. There is also potential for extending transiting time for fishing vessels and vessels leaving / approaching Milford Haven from the south. The significance of impact will be dependent on the construction port and selected landfall/cable route.
Recreational and commercial vessels	Displacement of anchorages.	Construction Operational Decommissioning	Yes	Displacement of informal anchorages could result in hindrances for the shipping industry. The significance of impact will be dependent on the construction port and selected landfall / cable route.
Recreational and commercial vessels	Impacts on navigational safety.	Construction Operational Decommissioning	Yes	The installation of any export cable protection in nearshore regions may potentially reduce the navigable water depth within the Project Area. If cable armouring is required, this would further reduce the navigable water depth within the export cable corridor.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Recreational and commercial vessels	Increased collision risk with other marine users.	Construction Operational Decommissioning	Yes	The presence of additional vessels operating in the Project Area has the potential to increase vessel to vessel collision risk. The significance of impact will be dependent on the distance between construction port and location of selected landfall / cable route.
Recreational and commercial vessels	Increased collision risk with Project devices.	Construction Operational Decommissioning	Yes	The physical presence of structures within the Project Area has the potential to increase the vessel to structure collision risk for vessels, including those drifting or without power. The physical presence of structures within the Project Area also has the potential to cause visual intrusion and noise impacts to other vessels.
Recreational and commercial vessels	Potential collision between passing / work vessels and project infrastructure.	Construction Operational Decommissioning	Yes	Activities associated with the proposed Project may diminish emergency response capability (including Search and Rescue (SAR) and pollution response) within the proposed Project Area.
Recreational and commercial vessels	Interaction with subsea cables.	Construction Operational Decommissioning	Yes	The significance of impact will be dependent on the selected landfall / cable route. As part of embedded mitigation, planned cables will be either buried or protected by rock placement to ensure they do not pose a risk to anchoring or fishing gear within the area. The project will also include mitigation to ensure that they are maintained throughout the life of the project and do not become exposed.
Recreational and commercial vessels	Increased collision risk between other marine users.	Construction Operational Decommissioning	Yes	The presence of additional vessels operating in the Project Area and the physical presence of structures within the Project Area has the potential to squeeze small craft into the routes of larger commercial vessels.

7.2.6 Proposed Approach to Environmental Assessment

To inform the baseline conditions for the EIA, an initial desktop study of existing AIS and vessel data collected previously for the Study Area will be undertaken, utilising existing data sets where available. Data gaps will be identified and addressed as appropriate.

Specific datasets that will be reviewed will include:

- Marine Accident Investigation Branch (MAIB) maritime incident data;
- Royal National Lifeboat Institute (RNLI) maritime incident data;
- Anchorage Areas Admiralty Charts To inform the baseline conditions for the EIA;
- International Maritime Organisation (IMO) routeing measures;
- Admiralty Charts;
- Admiralty Sailing Directions Admiralty Charts;
- Royal Yachting Association UK Coastal Atlas of Recreational Boating (2009) and GIS shapefiles;
- Area-specific data held by MHPA; and
- Regional shipping data collected via the 2x 14-day Project Erebus marine traffic surveys undertaken in August and November 2020.

An NRA will be undertaken and submitted in accordance with MGN 543 (and/or any updated version of MGN543 due in 2021), and taking account of MGN 372, and the MCA Methodology for Assessing the Marine Navigational Safety and Emergency Response Risks of Offshore Renewable Energy Installations.

Marine traffic surveys will be undertaken to inform the NRA process – see Table 7.3 below. MGN 543 requires that traffic studies should be completed within 24 months prior to the ES submission or they would expect a new traffic study to be undertaken.

The NRA process will include a Preliminary Hazard Analysis (PHA) and detailed stakeholder risk workshops. Amongst a range of navigation and safety issue, the NRA will also assess Under Keel Clearance (UKC) issues.

Table 7.3 - Proposed Shipping and Navigation Surveys to Inform the EIA

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Marine traffic (AIS, radar, visual)	Offshore array and export cable corridor with 10 km buffer	2 x 14 day surveys (Summer and winter)	To gather site-specific data on shipping activity in and around the proposed project area. Data will be used to inform the NRA and the eventual EIA process.

7.3 Coastal and Marine Infrastructure and Other Users

7.3.1 Study Area

The Study Area for coastal and marine infrastructure and other users encompasses an area of an approximate 50 km radius from the proposed offshore array area (in all directions) and also a distance of 5 km either side of the possible export cable routes and landfall locations.

7.3.2 Existing Baseline Data

This section has been informed by a desk-based review of a series of established data sources. These include:

- MMO Interactive Map (MMO, 2020);
- Lle Geo-Portal and the Wales Marine Planning Portal;
- GIS data from The Crown Estate;
- Environmental Report for Greenlink Interconnector (Intertek, 2019);
- Project Erebus EIA Scoping Report (MarineSpace, 2019);
- KIS-ORCA; and
- EMODnet.

7.3.3 Existing Baseline

Figure 7.3 identifies the range of coastal and marine infrastructure and other user activity in the vicinity of the project area. These are described further below.

7.3.3.1 *Military Activity*

The offshore array is located approximately 25 km outside the MoD Castlemartin Practice Areas, see Figure 7.3. Although the route is not yet finalised, the marine export cable may pass through the MoD Castlemartin Danger Area, depending on the identified landfall location. Information from the MoD suggests that for most of the year, only the smaller (nearest to shore) firing templates are used. However, for around 2 weeks of the year the larger templates are used with the potential of debris up to the boundary of the Danger Area. This will not directly affect the offshore array area.

Should the final export cable route does pass through this area it will be necessary to liaise with the MoD on the specific route and level of protection afforded to the cable to ensure no damage arises during firing exercises and other military activities.

In addition to routine firing operations at Castlemartin Range, radar communication and surveillance operations also occur here, as well as occasional Royal Navy operations, including low-flying exercises at times.

The MoD will be engaged with throughout the EIA for advice.

7.3.3.2 *Unexploded Ordnance (UXO)*

There are currently limited data available on the amount, type and distribution of UXO in the Study Area. However, due to the proximity of the inshore part of the Study Area to Castlemartin Range, the potential for UXO is judged to be high. As part of EIA characterisation surveys, magnetometer data will be collected that will be assessed for potential UXO issues.

7.3.3.3 *Marine Disposal Sites*

There are several marine disposal sites in this region. Details of these are provided below:

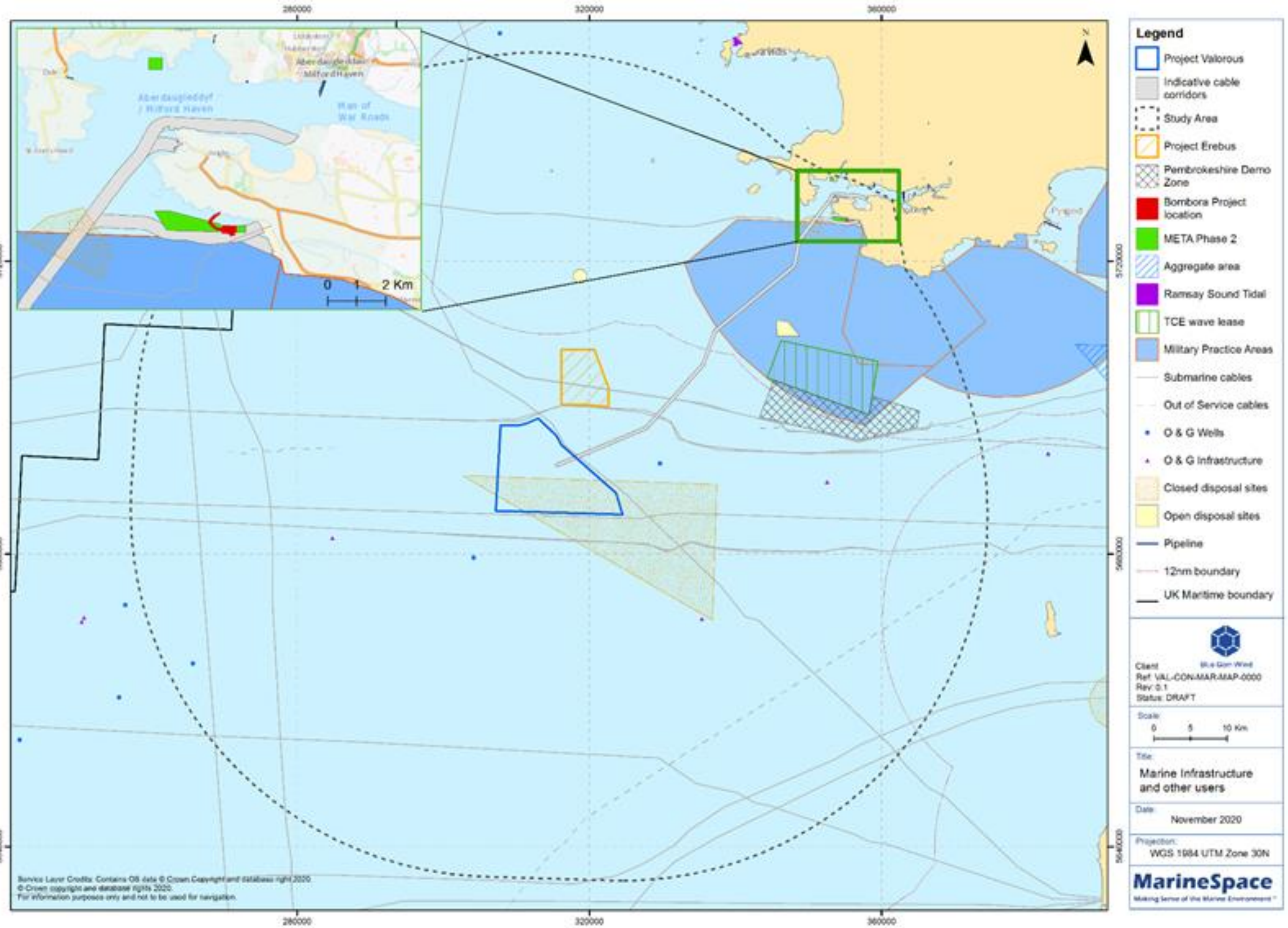
- Milford Haven Three (LU169): OPEN: located 19 km to the north of the offshore array;
- Milford Haven Industrial (LU040): CLOSED: located within the offshore array;

- Milford Haven Two (LU168): OPEN: located approximately 30 km to the east of the offshore array. Milford Haven Port Authority (MHPA) has predicted that, between 2018 and 2026, 480,000m³ of material will be disposed at LU169, with 88,000 m³ of coarse sand deposited at LU168;
- Milford Haven (LU170): CLOSED: located approximately 44 km to the northwest of the offshore array;
- St Anne's Head (LU180): CLOSED: located approximately 45 km to the northwest of the offshore array; and
- Closed ammunitions disposal site (which may contain UXO) that stretches along the Pembrokeshire coast.

7.3.3.4 ***Ports and Harbours***

A number of ports and harbours exist within the Study Area. Milford Haven is located 55 km from the offshore array and is the fifth largest port in the UK, handling over 35 million tonnes of cargo in 2019 (MHPA, 2020). The Milford Haven Port Authority (MHPA) provides port and associated services, as well as the navigational needs of the 3 major oil refineries in the Haven. Milford Haven Waterway also contains a passenger ferry service. Annually, the Milford Haven ferry terminal handles 62,000 Ro-Ro units and 325,000 passengers for Irish Ferries (MHPA, 2017). A twice daily ferry service runs from Pembroke Dock Ferry Terminal to Rosslare, Southern Ireland.

Figure 7.3 - Coastal and Marine Infrastructure and Other Users Study Area and Activities



7.3.3.5 *Subsea Cables*

There are several submarine cables (all telecommunication) of relevance to the proposed Project (Table 7.4).

Table 7.4 - Subsea Cables in Study Area

Cable Name (Asset Owner)	Status	Approximate Distance from offshore array	Approximate Distance from export cable corridor
Solas (Vodafone)	Active	5 km	Potential interaction dependent on landfall location of export cable
Tata Atlantic (Tata Telecoms)	Active	0.5 km	Potential interaction dependent on landfall location of export cable
UK-Ireland Crossing 2 (Level 3 Ltd)	Active	0.5 km	Potential interaction dependent on landfall location of export cable
TGN Atlantic (Tata Telecoms)	Active	0.5 km	Potential interaction dependent on landfall location of export cable
PTAT (Vodafone)	Disused	Overlaps with the boundary of the array area	6 km
Tata Western Europe UK-Portugal (Tata Telecoms)	Active	3 km	10 km
Hibernia Express	Active	0.5 km	6 km
Greenlink Interconnector (GIL)	In Planning (Marine Licence expected 2021)	27 km	Potential interaction dependent on landfall location of export cable

7.3.3.6 *Oil and Gas Extraction*

There is no existing or proposed oil and gas extraction infrastructure in proximity to the proposed Project, including the potential cable export route. There is also no gas storage or carbon capture storage infrastructure located in the vicinity of the proposed Project. No oil and gas blocks in recent licensing rounds have been offered or awarded in proximity to the proposed Project and potential cable export routes. There is 2 historic exploratory wellhead located approximately 7 km east and 7 km south of the Project.

7.3.3.7 *Aggregate Extraction*

There are no existing licensed, application or aggregate option areas in proximity to the proposed Project. The closest aggregate area is located approximately 66 km east of the site, in the Bristol Channel. Within the region of the proposed Project there are areas of potential future aggregate resource previous identified by the Crown Estate (The Crown Estate, 2019).

7.3.3.8 *Other Renewable Energy*

Project Erebus is a 96 MW FLOW development located approximately 4 km north of the proposed Project offshore array scoping site boundary. This site is not consented or operational at the time of writing. Application for consent is expected to be submitted in late 2021.

The Pembrokeshire Demonstration Zone (PDZ) is located approximately 22 km east of the proposed Project area. This site is not consented or operational at the time of writing. The site is eventually intended to provide a site for testing multiple offshore renewable energy devices (wave and FLOW), with a total maximum deployed capacity of 100 MW. Within the scoping report for the PDZ project, Freshwater West has been identified as a possible export cable landing location. The full EIA/consenting process has not yet commenced so it is unlikely that a consent application will be submitted till at least 2023 at the earliest.

The Marine Energy Test Area (META) is located 48 km to the north of the offshore array. The META project consists of eight test sites where marine energy testing activities will be permitted. 5 of the sites are defined as Phase 1 sites and are located within the Milford Haven waterway. Of the 3 remaining Phase 2 sites, one (East Pickard Bay) is located close to one of the potential landfall options for the proposed Project, off Freshwater West. This is the location where the proposed mWave device is intended to be deployed by Bombora Wave Power Ltd in 2022.

A Marine Licence has been issued for the Phase 1 sites but not for the Phase 2 sites. This is expected early 2021.

7.3.4 Identification of Key Sensitivities and Potential Impacts

Table 7.5 below summarises the potential impacts of the proposed Project on the coastal and marine infrastructure and other users identified as part of the preceding baseline assessment. Where no impacts are predicted on certain receptors these are identified and proposed to be scoped out of any future EIA.

7.3.5 Potential Mitigation

Relevant stakeholders, owners and operators with existing or proposed infrastructure that may interact with the project will be consulted, at an appropriate stage, in order to identify appropriate mitigation measures and legal agreements for consideration.

7.3.6 Proposed Approach to Environmental Assessment

Potential impacts on coastal and marine infrastructure and other users will be assessed using the standard EIA Methodology set out in Section 3. The impact assessment will consider the potential for impacts during the construction, operation and maintenance, and decommissioning phases of the Project. Impacts will be defined as:

- Direct impacts: these may arise from impacts associated with the construction, operation and maintenance, or decommissioning of the Project;
- Indirect impacts: these may be experienced by a receptor that is removed (e.g. in space or time) from the direct impact; and
- Cumulative impacts: these may occur as a result of the project in conjunction with other existing or planned projects within the study area for each receptor.

The impact assessment process will also rely heavily on targeted consultation with key stakeholders, such as the asset owners of existing subsea cables, MHPA and local port operators and the MoD.

Table 7.5 - Key Sensitivities and Potential impacts for Marine Infrastructure and Other Users

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Military Activity	Disruption to existing MoD and Royal Navy activity in and around the Castlemartin range and surrounding sea area	Construction Operational Decommissioning	Yes	The exact scope for construction activity and, subsequently, fully operational WTGs to interfere with MoD operations (including radars, communications and surveillance systems) is currently unknown and will require further assessment within the EIA.
Unexploded Ordnance (UXO)	Interaction with UXO has the potential to cause risk to life and damage to ecological receptors	Construction Decommissioning	Yes	Due to the proximity of military activity there is potential for encountering UXO and as such, assessment will be required within the EIA.
Closed Disposal Sites	Risk of construction works / vessels creating direct impacts (disturbance of spoil material) on known marine disposal sites.	Construction Operational Decommissioning	Yes	The nearest closed disposal site is located within the Project area, within the south of the site. Direct impacts (disturbance of spoil material) will require further assessment within the EIA.
Open Disposal Sites	Risk of construction works / vessels creating direct impacts (disturbance of spoil material) on known marine disposal sites.	Construction Operational Decommissioning	No	The nearest open disposal site is located 19 km to the north of the offshore array area. As no project infrastructure will be located in this disposal site, no direct impacts (disturbance of spoil material) are predicted.
Ports and Harbours	Disruption to routine port operations via project-related activities.	Construction Operational Decommissioning	Yes	The exact scope of interference on existing port operations (including vessel movements; maintenance dredging) is not clear and will require further assessment within the EIA.
Cables	Damage to existing cables	Construction Operational Decommissioning	Yes	No active cables cross the offshore array area however the proposed export cable route would cross the ‘Solas’ telecommunication cable ‘Tata

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
				Atlantic' telecommunication cable and Century Link's UK-Ireland Crossing. Construction activities for the proposed Project may interact with these existing cables and cause damage. Depending on export cable routing, there is also high potential for interaction with the Greenlink interconnector cable, potentially resulting in interference to the cable.
Aggregate Extraction	Potential impact on licensed marine aggregate activities	Construction Operational Decommissioning	No	No licensed marine aggregate activities occur within the study area so there is no scope for impacts.
Oil and Gas Operations	Potential impact on licensed oil and gas exploration activities	Construction Operational Decommissioning	No	No licensed oil and gas exploration activities occur within the study area so there is no scope for impacts.
Other Renewable Energy Projects	Potential adverse impacts on planned marine renewable energy projects in the Study Area	Construction Operational Decommissioning	Yes	The exact scope of interference on other planned marine renewables energy projects (PDZ; META; Bombora; Erebus) is not clear and will require further assessment within the EIA.

7.4 Aviation and Radar

7.4.1 Study Area

The extent of the Study Area for the assessment of impacts on aviation and radar is set out in Figure 7.4 and has been informed using the National Air Traffic Services (NATS) 'self-assessment maps' (NATS, 2017a). The available spatial data layers illustrate any potential interactions with 54 air-ground-air communication stations, 55 navigation aids and 20 secondary surveillance radars operated by NATS En Route plc (NERL) in the UK.

7.4.2 Baseline Data

Information on the location and type of aviation and radar receptors that may be impacted by the proposed Project have been collated from NATS and Ministry of Defence (MoD) sources. Information presented in the Pembrokeshire Demonstration Zone EIA Scoping Report (Wave Hub, 2018) has also been reviewed and presented, where appropriate.

7.4.3 Existing Baseline

7.4.3.1 Airports

The closest commercial airport to the Project Area is Cardiff, approximately 150 km from the offshore array. Other commercial airports are located at Bristol (200 km from offshore array), Exeter (170 km from offshore array) and Newquay (120 km from offshore array). Aerodromes that support light aircraft traffic also exist at Haverfordwest (56 km from offshore array) and Swansea (104 km from offshore array).

7.4.3.2 Military Airfields

The closest operational RAF base to the offshore array area is MoD St Athan in the Vale of Glamorgan (approximately 140 km from the offshore array). MoD St Athan is home to No. 4 School of Technical Training which provides continued training to personnel from all 3 Services and MoD civilian staff. MoD St Athan is also home to the University of Wales Air Squadron.

RAF Valley, on Anglesey, is located approximately 200 km to the north of the offshore array area. RAF Valley is home to No. 4 Flying Training School and the Mountain Rescue Service, the military's only high readiness, all weather search and rescue, aircraft post-crash management asset. Whilst these RAF stations are >100 km away from the offshore array, aircraft operating from these bases may transit through the airspace above the offshore array, where the WTGs will be located.

7.4.3.3 International Air Traffic Services

International commercial flights are controlled by national air traffic control centres who control their respective Flight Information Ranges (FIR). The London FIR covers England and Wales, including the proposed Project offshore array area. The London FIR is split into UK Airspace Sectors and the boundary of 2 sectors (Brecon and Berryhead) crosses the Study Area.

The UK Civil Aviation Authority (UKCAA) is the regulatory authority for the London FIR and air traffic services are provided by NERL (NATS, 2017b). NERL has extensive infrastructure in place across the UK, to ensure that aircraft flies safely and efficiently; comprising radars, communication systems and navigational aids.

7.4.3.4 Primary Surveillance Radars

There are 3 primary surveillance radars in the wider region, all located in North Devon. There is also an important aviation navigation beacon located at Strumble Head, north

Pembrokeshire. (based on NATS' self-assessment maps of November 2020), Figure 7.4 indicates that WTGs with a height range of 270 m may be within the line of sight of the primary surveillance radars (PSRs) operated or used by NERL which provide *en-route* services to civil and military aircraft. Further consultation will be undertaken with NATS to establish the potential for adverse impacts on PSRs and any mitigation measures that may be required.

The location of secondary surveillance radars (SSRs) with a 10 km buffer, (e.g. Strumble Head), are also shown in Figure 7.4 NATS advises that effects on SSRs are only relevant to consider when WTGs are located less than 10 km from the SSR. As Figure 7.4 shows, the offshore array lies outside the area of interaction with any SSR.

7.4.3.5 Aeronautical Navigational Aids and Communication Systems

Installation and operation of the proposed WTGs has the potential to impact a wide range of aviation navigation aids and communication systems, including air-ground communications facilities. The effects of potential interactions between Air Traffic Controls (ATCs) and aircraft are currently being investigated further, with reports to be published in due course. In the meantime, the UKCAA's guidance (Section GEN-01 of CAP 670) should be adhered to.

7.4.3.6 Offshore Helicopter Operations

Unlike locations in other parts of the UK, where there are oil and gas facilities that require regular crew transfers, commercial offshore helicopter operations in this region are limited to Search and Rescue (SAR) operations. In 2013, Bristow Helicopters Ltd won the UK Government national contract to deliver SAR operations on behalf of the Maritime and Coastguard Agency (MCA).

Bristow now operates on behalf of Her Majesty's Coastguard from 10 coastguard helicopter bases around the UK, responding to all SAR incidents for the whole of the UK. The closest SAR helicopter bases to the proposed Project area are St Athan (Vale of Glamorgan) and Newquay (Cornwall). SAR operations often involve flying at less than 1,500 ft (457 m). Assessment of potential impacts on SAR operations will be assessed within the project-specific NRA and will adhere to guidance set out in MGN543.

7.4.3.7 MOD Flying Areas

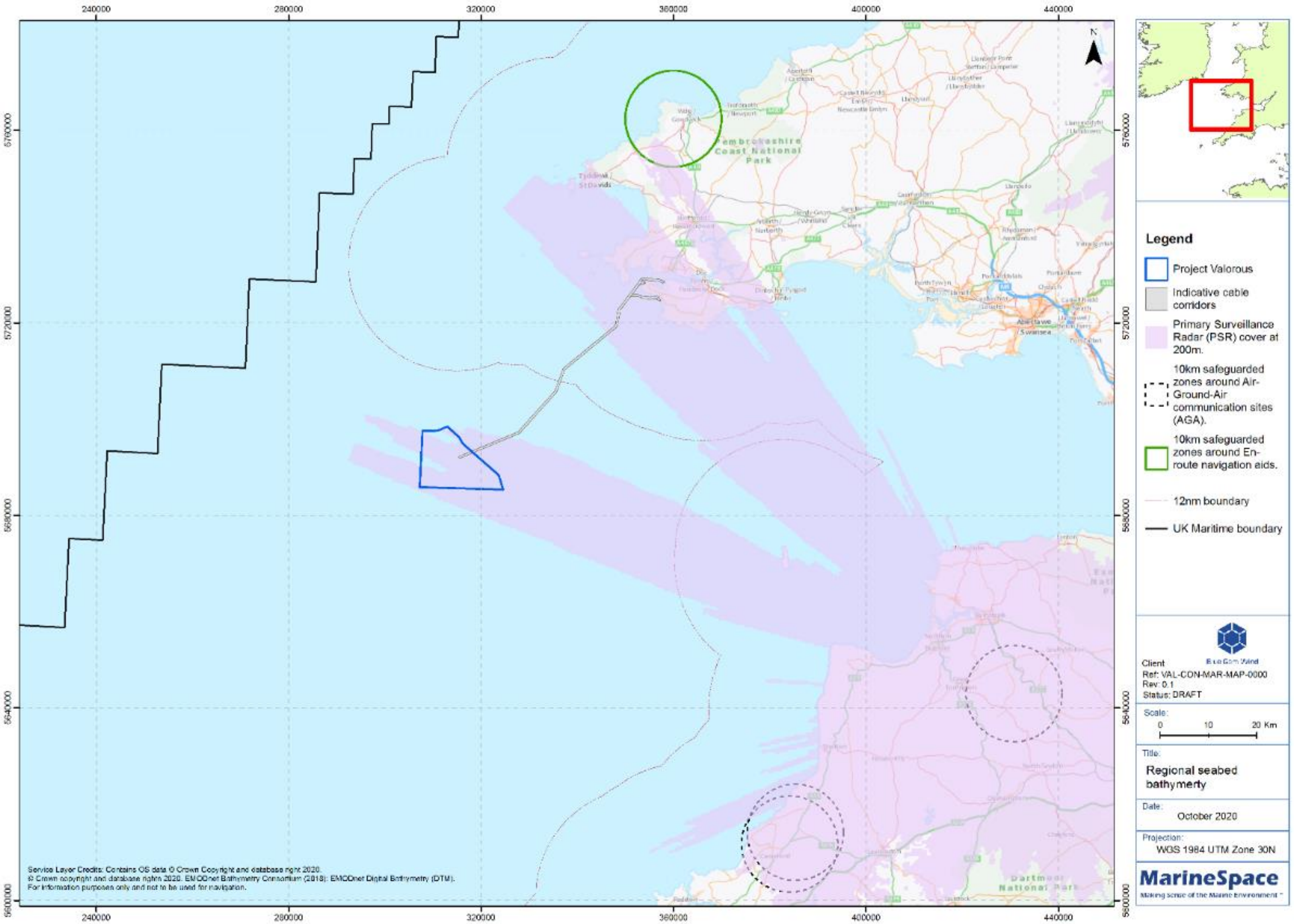
The offshore array area is located approximately 20 km outside the MoD Castlemartin Practice Areas. The offshore array area is within a low priority military low flying training area.

Potential impacts are outlined below in Table 7.6.

7.4.4 Potential Mitigation

Mitigation measures are to be explored at the earliest opportunity with relevant authorities. This will include adherence to the guidance documents specified above. Mitigation measures may include the use of aviation warning lighting fitted to WTG masts, and the marking of WTGs on aeronautical and nautical charts, as required by navigational and aviation safety requirements, such as the Air Navigation Order 2016. Other offshore windfarms in the UK have mitigated impacts using technologies that remove clutter (the Non-Auto Initiation Zone) from radar signal.

Figure 7.4 - Aviation and Radar Receptors in Study Area



7.4.5 Identification of Key Sensitivities and Potential Impacts

Table 7.6 - Identification of Key Sensitivities and Potential Impacts to Aviation and Radar

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
All aircraft	Increased collision risk due to offshore WTG infrastructure.	Construction Operational Decommissioning	Yes	Risk of collision due to interference with radar and communications systems.
Primary Surveillance Radar	Physical obstruction of WTGs and the generation of unwanted returns (returns that are not aircraft) to radar. Interference.	Construction Operational Decommissioning	Yes	Risk of collision due to interference with radar.
Aeronautical navigation aids and communication systems	Possibility of WTGs interfering with radio communication between Air Traffic Controllers and aircraft under their control.	Construction Operational Decommissioning	Yes	Risk of aircraft collision due to interference with communications systems.
Offshore helicopter operations (SAR)	Risk of interaction between SAR helicopter service and offshore infrastructure.	Construction Operational Decommissioning	Yes	Offshore search and rescue helicopter operations could be affected adversely by WTGs.

7.4.6 Proposed Approach to Environmental Assessment

A pre-planning assessment will be undertaken in conjunction with NATS as soon as possible in the EIA process. This assessment will determine the scope for the proposed project to raise concerns from the 2 main aviation stakeholders: (1) NATS; and (2) airport authorities.

At many UK airports, NATS provides ATC services and also some safeguarding services. It is often the ATC provider who delivers technical and operational advice on OWF applications, in which case they advise the airport authority on whether to object or not. However, the airport authority will make the ultimate decision.

The following assessments will be required:

Airport Technical: This will look at radar line of sight to determine whether or not the proposed development is likely to produce returns on any radars. It will also assess the potential impact on communications and navigation equipment;

Operational: This will take the results of the technical assessment and pass them to the operational units that use the assets. The unit assessors will then decide if the proposal might have an impact on the specific operational criteria in place at that unit;

Obstacle Limitation Surface (OLS) assessment: This examines the physical safeguarding of any local airport and the protection of various surfaces. In general, the OLS assesses surfaces up to 15 km from a runway. It is designed to ensure that obstacles do not prevent normal airport operations; and

Instrument Flight Procedures and ATC Surveillance Minimum Altitude Chart (IFP / ATCSMAC): This assessment will check the effect that obstacles might have on the Instrument Flight Procedures and the minimum levels that can be allocated under radar control at the airport.

Following consultation with NATS, it is proposed that one of the following assessments will be requested to be provided by NATS:

- Airport Technical and Operational Assessment (TOPA). This includes technical and operational assessments in relation to airport assets. The report details the likely impact and the operational response of the relevant ATC unit;
- *En-route* TOPA. This includes technical and operational assessments in relation to *en-route* assets. The report details the likely impact and the operational response of the relevant ATC centre; and
- Combined Airport and *En-route* TOPA. This includes both an airport and *En-route* TOPA.

Once key potential impacts are identified, they will be assessed using the standard EIA matrix set out in Section 3.

No project-specific surveys are proposed with respect to aviation and radar.

7.5 Archaeology and Cultural Heritage

7.5.1 Study Area

The Study Area for the scoping assessment can be seen in Figure 2.1 and comprises: the offshore array area, potential offshore cable routes, landfall, onshore cable routes and associated onshore substation, adjacent to Pembroke Power Station.

7.5.2 Existing Baseline Data

The baseline data reviewed to inform this high-level desk-based assessment includes:

- Milford Haven Area Historic Landscape Characterisation (Cadw, 2001);
- West Coast Palaeolandscapes Study (Fitch and Gaffney, 2011);
- A Research Framework for the Archaeology of Wales (IFA Wales, 2016);
- Lle, Geo-Portal for Wales (Lle, 2020);
- Project Erebus EIA Scoping Report (MarineSpace, 2019); and
- Wales Marine Planning Portal (Welsh Government, 2020).

No Project-specific surveys have been undertaken to inform this report. As noted above further detailed searches and reviews will be required for the full EIA. Details of the data searches are provided in Section 7.5.6.

7.5.3 Baseline Environment

7.5.3.1 *Offshore Archaeology and Cultural Heritage*

Within the offshore region of the proposed Project, the Quaternary geology of the marine environment is identified as till with thin layers of recent marine sediments (Holocene sands and gravelly sands) overlaying the bedrock (BGS, 2020; Intertek, 2019), thickening offshore in the west. There is a high tidal range in the area, described in further detail in Section 5.1.4, indicating potential for the movement of sediment through the region. The presence of exposed bedrock suggests that there is potential for burial and exposure in localised areas.

The West Coast Palaeolandscapes Survey (WCPS) is a large regional assessment undertaken by the University of Birmingham (Fitch and Gaffney, 2011). Focusing on Late Quaternary and Holocene landscapes, the Study Area is located east of the proposed Project Figure 7.5. However, its findings indicate that palaeochannels and flood plain deposits (peat and organic material) may be present to the west of the Project. Peat beds were identified at Frainslake Sands, near Freshwater West (Site No. 8.43.1; OSPAR) between 1995-2005 (Lle, 2020; Welsh Government, 2020), indicating potential for palaeolanscapes to be identified in the region. The WCPS indicates that there is a high potential for surviving deposits, however with no offshore ground truthing, this potential is unverified.

The geology and dynamics of the Study Area indicates a low to medium potential for palaeolandscapes or in-situ palaeoarchaeology, that increases closer to shore and at potential landfall locations, where sites have previously been identified; for example, flint artefacts in the vicinity of Freshwater West.

Known sites of archaeology and cultural heritage, specifically maritime or aviation sites were reviewed via the Wales marine planning portal (Welsh Government, 2020). Currently, the nearest protected site is located to the northwest of the scoping Study Area, on The Smalls reef (Figure 7.5), where an 11th Century Viking sword hilt was located amongst the rocks (Reference No. DW4; Welsh Government, 2020). A large number of sites present in the National Monuments Record of Wales (identified from documented losses, non-designated known and unknown wrecks), are present off the Pembrokeshire coast (Welsh Government, 2020) (Figure 7.5).

With the close proximity of the historic port of Milford Haven, and the local conditions of submerged rocks and reef, the distribution of wrecks is to be expected, with a greater cluster around the mouth of the estuary. Further data relating to a full list of records will be reviewed for the EIA, see Section 7.5.6. It is noted that some non-designated wrecks and their locations have been identified from historic surveys; however, some wreck locations are identified only by the snagging of fishing gear, and as such the positioning is less accurate. It is understood that although these records are of great importance in identifying potential, confirming presence or absence using geophysical methods is highly recommended.

There is potential for previously undiscovered wrecks and aircraft to be present within the region however, the preservation potential of the marine environment in this region is limited by shallow sand coverage, meaning a limited burial potential, and by the likely erosion of exposed surfaces in such a high energy environment, as noted above.

This suggests that potential for the discovery of previously undiscovered wrecks is low within the offshore scoping Study Area in comparison, for example, to marine areas where there is substantial sand coverage and correspondingly higher potential for burial. The potential increases further inshore, within areas of mobile sediment coverage, see Section 5.1.

7.5.3.2 *Onshore Archaeology and Cultural Heritage*

This section considers onshore archaeology and cultural heritage, and the overlap between onshore and offshore at potential landfall locations.

As discussed in Section 7.5.3.1, exposed peat beds have been recorded to the south of Freshwater West, with tree stumps, fallen trees, roots and branches, dated to 5250-4550 BC (Intertek, 2016). Storms in 2013-2014 also exposed wrecks on Freshwater West beach, including the 'Upside down wreck', identified as Willemoes of Thuro, a wooden schooner built in 1911 (Welsh Government, 2019). The recent discovery of recorded wrecks recognise the potential for additional sites to be identified. There are recorded losses also present on and around Bullslaughter Bay (Welsh Government, 2019).

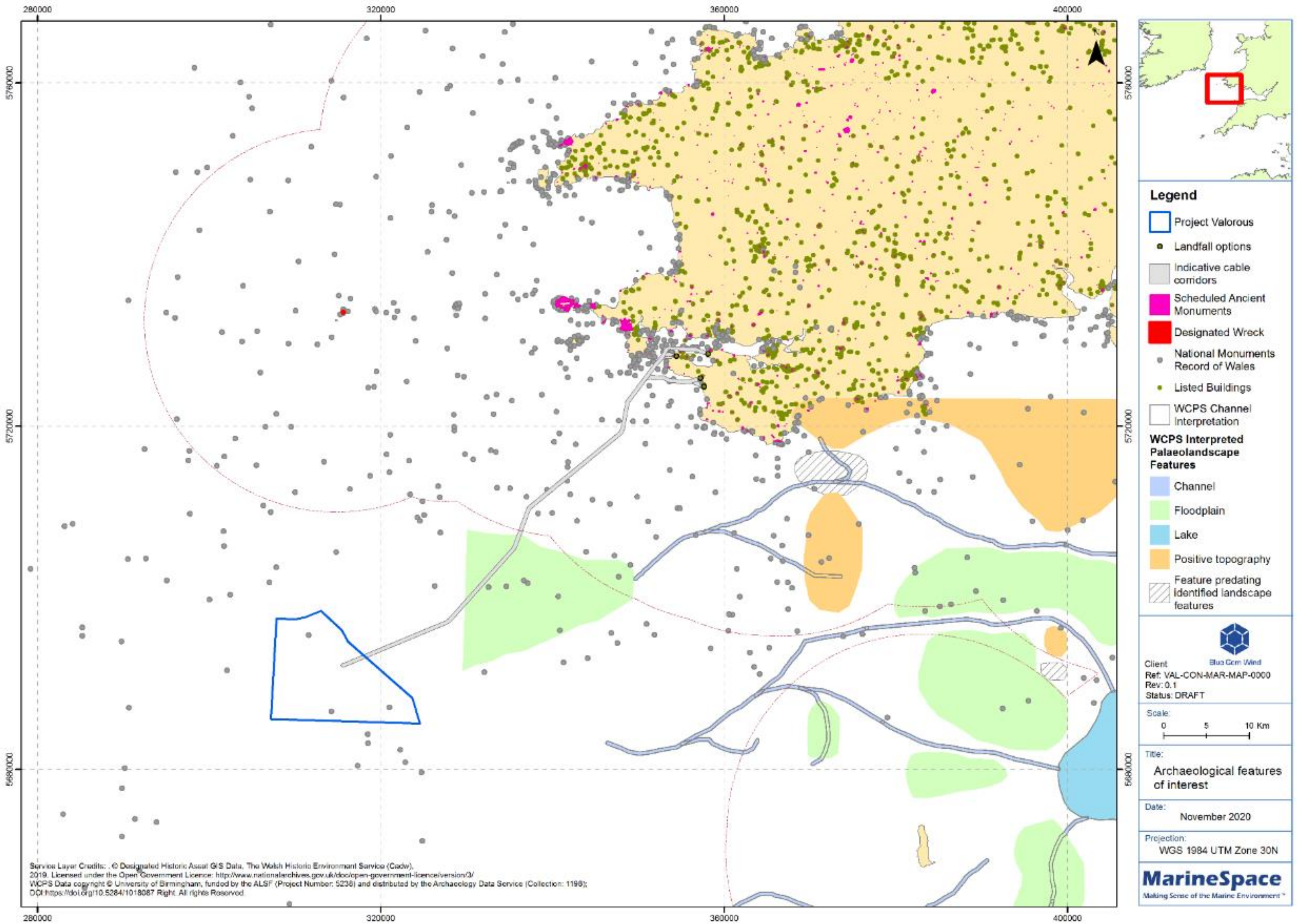
In the vicinity of potential landfall sites are a number of designated sites, including Scheduled Ancient Monuments (SAMs; Lle, 2019) (Figure 7.6). A selected number of these have been listed here, further detailed assessment will be undertaken once landfall and onshore cable routes have been confirmed:

- West Angle Bay Early Medieval Settlement – Medieval Cemetery (sixth to tenth centuries AD) on the cliff top overlooking West Angle Bay;
- Crocksydam Camp – Prehistoric Promontory Fort (c. 800 BC – AD 43) on the headland by Bullslaughter Bay;
- Linney Tobruk Shelters – coastal battery built 1943 south of Freshwater West;
- Gravel Bay – anti-aircraft battery from WWII, located north of Freshwater West;
- Crow Back Tumulus – round barrow of Bronze Age (c. 2300 – 800 BC), located south of Freshwater West; and
- Devil's Quoit Burial Chamber – a Chambered tomb of Neolithic period (c. 4,400 BC – 2,900 BC), located northeast of Freshwater West.

Pembrokeshire County Council and Pembrokeshire Coast National Park have designated Conservation Areas in this region. These will be reviewed once the scheme details and location are finalised.

In addition to these designated sites, there are a large number of non-designated heritage assets. These assets provide evidence of human activity from early Prehistoric through to Modern times and a full assessment of these will be required as part of the EIA.

Figure 7.5 - Archaeological Features of Interest (Sources: Lle, 2020; Fitch and Gaffney, 2011)



7.5.4 Identification of Key Sensitivities and Potential Impacts

The key sensitivities for archaeology and cultural heritage include:

- Palaeolandscape features, including submerged peat and organic deposits;
- Maritime wrecks and debris;
- Aviation wrecks and debris;
- Historic Landscape and Seascape Character; and
- Designated sites and listed buildings.

These sensitivities can be impacted directly or indirectly from the proposed Project. Direct impacts on heritage assets involve permanent damage or destruction of archaeological material or its physical setting (context), with no ability to replace what has been lost. This would include impacts from the footprint of construction, operation, maintenance and decommissioning of the proposed Project, as well as its associated activities. This type of impact would be considered of major significance.

Indirect impacts occur when direct impacts have effects beyond their primary footprint, which can affect archaeological sites or materials some distance away by a change in the hydrodynamic or sedimentary process caused by installation of infrastructure or associated activities. These processes can trigger either a negative effect by degradation of the heritage asset or context, by physical, biological or chemical processes; or a positive effect by preservation of the heritage asset via burial.

Key sensitivities and potential impacts associated with the proposed Project to be considered as part of the full EIA are listed in Table 7.7.

Table 7.7 - Key Sensitivities and Potential Impacts for Archaeology and Cultural Heritage

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Buried Archaeological /(Palaeo) Environmental Remains	Direct impacts on sites within the footprint of the proposed Project causing destruction or damage of the assets. Indirect impact associated with changes to marine and coastal processes	Construction Operational Decommissioning	Yes	High potential for an impact to be of permanent negative effect, and without mitigation would be of major significance. Exposure of buried remains following changes to marine or coastal processes could result in increased degradation. Conversely, burial of remains caused by changes to marine or coastal processes could be considered positive.
Maritime and Aviation Sites	Direct impacts on sites within the footprint of the proposed Project causing destruction or damage of the assets. Indirect impact associated with changes to marine and coastal processes.	Construction Operational Decommissioning	Yes	High potential for an impact to be of permanent negative effect, and without mitigation would be of major significance. Exposure of buried remains following changes to marine or coastal processes could result in increased degradation. Conversely, burial of remains caused by changes to marine or coastal processes could be considered positive.
Marine and Intertidal Heritage Assets	Direct impacts of sites within the footprint of the proposed Project. Indirect impacts associated with changes to marine and coastal processes.	Construction Operational Decommissioning	Yes	High potential for an impact to be of permanent negative effect, and without mitigation would be of major significance. Exposure of buried archaeological remains following changes to marine or costal processes could result in increased degradation of those remains. Conversely, increased burial of remains previously exposed to marine processes could be considered a positive impact.

Topic / Receptor	**Potential Impacts**	**Project Phase**	**Further Assessment at EIA Stage (scoped in)**	**Rationale for Impact Scoped In / Out**
Onshore Heritage Assets	Impacts to the setting of heritage assets.	Construction Operational Decommissioning	Yes	Potential that the introduction of a new development, with associated activities, could negatively affect the setting of heritage assets without mitigation.
Historic Landscape and Seascape	Changes to the historic character of the area.	Construction Operational	Yes	High potential that the introduction of a new development, with associated activities, could negatively affect the setting of the heritage asset without mitigation.
Current Archaeological Research in Wales	Potential positive impact of publishing fieldwork results and archaeologically assessed geophysical and geotechnical data, as well as any finds identified.	Construction	Yes	The acquisition of new information on shore and offshore through geophysical, geotechnical and fieldwork surveys could significantly contribute to the understanding of archaeology in the region.

7.5.5 Potential Mitigation

A full assessment of the significance of these impacts and potential mitigation would be considered during the EIA and would be based on the key Project parameters defined at this stage. The following standard mitigation practices, will be applied where necessary:

- Avoidance of known heritage assets (preservation *in situ*):
  - Implementation of Archaeological Exclusion Zones (AEZ) around identified marine and terrestrial heritage assets;
  - Micro-siting of design to avoid marine geophysical anomalies of possible archaeological interest; and
  - Micro-siting of design to avoid known, onshore heritage assets.
- Further investigation and excavation of heritage assets which cannot be avoided (preservation by record):
  - Geoarchaeological assessment and the production of a Quaternary sedimentary deposit Model;
  - Further investigation of marine heritage assets through the acquisition of high-resolution geophysical data, and where necessary Remote Operated Vehicle (ROV) or diver survey (in unavoidable route areas);
  - Onshore fieldwork / excavation including set-piece (open-area) excavation, strip, map and record (or sample) excavation and watching briefs (targeted and general); and
- Adherence to the Offshore Renewables Protocol for Archaeological Discoveries (ORPAD) (The Crown Estate, 2010) to address unexpected discoveries of archaeological material during construction offshore.

All mitigation measures would be set out in a draft Written Scheme of Investigations (WSI) to reflect the proposed approach to archaeological mitigation for onshore, intertidal and offshore works associated with the proposed Project. Fieldwork would include subsequent post excavation assessment, and analysis, publication and archiving (where appropriate).

7.5.6 Proposed Approach to Environmental Assessment

A final archaeological and cultural heritage Study Area, comprising the proposed Project area (offshore array, export cable corridor, intertidal and onshore) plus an appropriate buffer (likely a 1 km) will be established, and form the basis for data acquisition. The buffer will ensure that all heritage assets adjacent to, or in proximity of, the footprint of the proposed works are incorporated in the assessment. A larger Study Area to assess settings impacts may be relevant, in accordance with the landscape, seascape and visual impact assessment undertaken for the Project.

In line with requirements specified in Planning Policy Wales, Note 24 (Cadw, Welsh Government, 2017a), Table 7.8 summarises the data collection that will be undertaken to achieve a proportionate assessment for archaeology and cultural heritage.

Table 7.8 - Proposed Additional Data Collection for Archaeology and Cultural Heritage

Data Requirement	Method	Purpose / Rationale
Records held by Cadw on designated sites	Request record search from the defined Study Area directly from Cadw.	To identify the nature and extent of designated heritage assets which could be impacted by the Project.
Information held by Pembrokeshire County Council and Pembrokeshire Coast National Park on conservation area and assets of local interest	Information available online or from Dyfed Archaeological Trust as archaeological advisors to PCC and PCNPA.	To identify the nature and extent of historic areas and locally designated assets which could be impacted by the Project.
Records from the Historic Environment Record (HER) maintained by Dyfed Archaeological Trust	Request record search from the defined Study Area directly from Dyfed Archaeological Trust.	To identify the nature and extent of non-designated heritage assets which could be impacted by the Project.
Records from the National Monuments Record of Wales, held by RCAHMW	Request record search from the defined Study Area directly from RCAHMW.	To identify the nature and extent of non-designated heritage assets which could be impacted by the scheme and to use records of maritime and aviation losses to assess the potential for previously undiscovered wrecks and aircraft offshore.
Records of wrecks and obstructions held by the UKHO	Request record search from the defined Study Area via either UKHO or a third-party provider.	To identify the locations of wrecks and obstructions previously recorded within the Study Area and to evaluate their archaeological potential.
Records of finds from the Receiver of Wreck	Request record search from the defined Study Area directly from the Receiver of Wreck.	To identify the locations of finds indicating wrecks or other potential heritage asset which could be impacted by the scheme.
Geoarchaeological assessment of geotechnical data from Project data collected and existing data sources via the BGS GeoIndex (offshore)	Specialist geoarchaeological contractor required to undertake assessment of current available geotechnical survey data. Further Project-specific surveys will take full account of relevant guidance to ensure that data collected are suitable for archaeological analysis.	To investigate the presence of sub-surface archaeological deposits and palaeoenvironmental data for geoarchaeological assessment and analysis and the production of a Quaternary sedimentary deposit Model (this is in part a mitigation measure as well as a data requirement).

Data Requirement	Method	Purpose / Rationale
Archaeological assessment of marine geophysical data	Specialist archaeological contractor required to undertake assessment of current available geophysical survey data. Further Project-specific geophysical survey will take full account of relevant guidance to ensure that data collected are suitable for archaeological analysis.	To identify the locations of wrecks, aircraft crash sites and geophysical anomalies of possible archaeological interest.
Targeted investigation and survey of areas of archaeological potential onshore	Where identified as required by the DBA, walkover surveys or site visits to ground truth the results and undertake settings assessments. Recommendation for geophysical survey, metal detecting, fieldwalking, earthworks surveys and trial trenching to be identified and undertaken by a specialist archaeological contractor, where required.	To provide further information on the presence of buried archaeological remains within the onshore export cable corridors and substation sites.
Results of specialist assessments undertaken for the Project.	Modelling associated with marine geology, geomorphology and sedimentary processes and marine coastal processes and with landscape, seascape and visual impacts.	To provide detailed assessment of changes to hydrodynamic and sedimentary process that may indirectly impact heritage assets and to understand the interaction of elements of the Project with the setting of heritage assets.
Historic maps and charts, aerial photography and LiDAR data	Data from third party providers and online resources, as applicable.	To provide further information, where possible, on the historic landscape / seascape and on the potential for heritage assets to be present within the Study Area.
Secondary sources and archaeological research	Search of online and published sources.	To provide contextual information relating to the archaeology and character of the Study Area.

As noted in Table 7.8, a summary of the surveys that may arise from the DBA are provided in Table 7.9. The assessed onshore and marine data will, in conjunction with existing records of, for example, scheduled monuments, wrecks, obstructions and documented losses, help to establish the full nature and extent of heritage assets both onshore and offshore.

Table 7.9 - Proposed Archaeological Surveys to Inform the EIA

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Marine geophysical survey	Minimum 1 km buffer around Project footprint	Summer	To undertake the acquisition of geophysical data (including, multibeam bathymetry, multibeam backscatter, sidescan sonar, sub-bottom profiler and magnetometer data) to identify sites of potential archaeological interest
Walk over survey	Selected sites onshore, at landfall and along cable route	Summer	To identify sites of archaeological potential, if the significance of archaeological remains cannot be adequately defined by the DBA
Onshore geophysical survey	At sites identified by the DBA and / or walk over	Post DBA	To identify sites of archaeological potential if the significance of archaeological remains cannot be adequately defined by the DBA
Visual inspection	Selected locations with viewpoints	Summer	To assess the cultural heritage landscape

The assessment will be carried out in accordance with the Welsh Government (Cadw) guidance, plus further relevant industry guidance and best practice advice notes including, but not limited to:

- Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology, 2007);
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology, 2008);
- Code of Practice for Seabed Development (Joint Nautical Archaeology Policy Committee, 2008);
- MoDel Clauses for Archaeological Written Schemes of Investigating: Offshore Renewables Projects (The Crown Estate 2010);
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2011);
- Marine Geophysics Data Acquisition, Processing and Interpretation: Guidance Note (EH, 2013);

- Standard and Guidance for Historic Environment Desktop Based Assessments (CifA2014) and Code of Conduct (CifA, 2017);
- Standard Guidance for Archaeological Geophysical Survey (CifA, 2016); and
- Protocol for Archaeological Discoveries (PAD), (The Crown Estate 2014).

Any relevant information obtained from the DBA and evaluation stages on mitigation will inform the EIA and be embedded in the Project's design in order to avoid impacts to known heritage assets.

Consultation will be undertaken at key stages throughout the assessment process with key stakeholders, such as Cadw, PCC, PCNPA and Dyfed Archaeological Trust, including discussions to confirm the scope of archaeological assessment and surveys.

7.6 Land Use

7.6.1 Study Area

The Study Area, see Figure 7.6, incorporates the landward aspects of the proposed Project, coinciding with the area assessed in Section **Error! Reference source not found.** (Terrestrial Ecology). The area extends from the Mean Low Water Mark (MLWM) and includes the preferred landfall sites, onshore cable route options and proposed onshore substation locations.

7.6.2 Baseline Data

The assessment is based on a desk top study utilising publicly available information and documents from the following sources:

- Pembrokeshire Coast National Park Local Development Plan, September 2020 (PCNP, 2020);
- Pembrokeshire County Council Local Development Plan, February 2013 (PCC, 2013);
- NRW Terrestrial Phase 1 Habitat Survey – habitat cover data derived from recording undertaken in 1979 and updated in 1991 (Lle, 2019);
- Erebus Project – Preliminary Ecological Assessment of Potential Cale Routes and Substation Locations near Angle and Rhoscrowther, Pembrokeshire (Jon Hudson Ecological Consultancy, 2020);
- NBN Atlas (NBN Atlas, 2020); and
- Magic (Defra, 2020).

Additionally, members of the project team undertook a site walkover of the prospective landfalls, cable route corridors, and substation site search area in summer 2020. This work was undertaken as part of the constraints assessment and design iteration for the Erebus floating wind project, however it covered much of the onshore study area applicable to the proposed Project and therefore the information gained on current land use is directly relevant.

7.6.3 Existing Environment

Land use in the terrestrial parts of the Study Area can be broadly defined into the following categories, for which further details are provided below:

- Settlements;
- Industrial;
- Military;
- Pembrokeshire Coast National Park (including the coastal strip); and
- Agriculture

The primary urban and suburban centres within or close to the Study Area are Pembroke and Pembroke Dock, located to the northeast of the peninsula. The peninsula is primarily rural in nature, and is characterised by small villages scattered across the Study Area including Stackpole, Bosherston, Maiden Wells, Angle and Hundleton.

The peninsula is bordered to the north by the Milford Haven Waterway, (which itself lies within the boundaries of the Pembrokeshire Marine Special Area of Conservation (SAC). Milford Haven is a critically important port for the energy industry as well as supporting a Wales-Ireland passenger and vehicle ferry and numerous other commercial and recreational activities.

In the north of the study area and serviced by Milford Haven Port Authority (MHPA) is the Valero Oil and Gas Refinery, a strategic energy site, critical for the energy security of the UK. To the east of the Valero refinery is the 2,000 MW combined-cycle gas turbine (CCGT) Pembroke Power Station; owned and operated by RWE Innogy. The anticipated grid connection point for this proposed Project will be close to this existing power station. Both sites fall within the Haven Waterway Enterprise Zone, which stretches to the north across the Waterway to incorporate other key energy facilities, including South Hook Liquefied Natural Gas (LNG) regasification plant (the largest LNG terminal in Europe), the smaller Dragon LNG terminal, and the Valero Gas Terminal (Business Wales, 2018).

Several solar farms are located across the peninsula, those relevant to the proposed Project include Hoplass and Wogaston Farm, Rhoscrowther; and Chapel Farm, St Twynnetts.

The Greenlink project, a 500 MW subsea cable electricity interconnector linking existing grids in Ireland and Wales, is proposed to make landfall at Freshwater West, with an onshore cable route to a substation located to the southeast of Pembroke Power Station (Greenlink, 2020).

Pembrokeshire Coast National Park (PCNP) is the UK's only coastal national park and is one of only 3 in Wales. PCNP was designated in 1952 and Pembrokeshire Coast National Park Authority (PCNPA) was established in 1996 to manage the Park and implement the following 2 statutory duties:

- To conserve and enhance the natural beauty, wildlife and cultural heritage of the National Park; and
- To promote opportunities for public enjoyment and understanding of its special qualities.

Approximately 50% of the Study Area falls within the PCNP, the rest is within Pembrokeshire County Council (PCC) jurisdiction. The National Park is primarily private land, and across the Study Area ownership is spread between residential and farm ownership and several large landowners including the MoD, National Trust, Valero and RWE Innogy.

The coastal strip falls within the PCNP boundary and, within the Study Area, includes a number of beaches (e.g. Freshwater West; West Angle Bay), more secluded coves and bays (e.g. Bullslaughter Bay) and other coastal habitats (e.g. sea cliffs, sand dunes). More details on key coastal and terrestrial ecological habitats are provided in other relevant sections of this report.

One of the most important aspects of land-use in the southern and western part of the peninsula is the Castlemartin firing range which, covers approximately 5,900 hectares. The range is the only UK range available for direct-fire live gunnery exercises with both on-land impact areas and a large offshore safety area (Defence Estates, 2018). Merrion Camp is part of the Castlemartin training area and located to the north of the firing range.

Another key land-use in the Study Area is agriculture, with these areas primarily comprising grassland, pastoral land for sheep, beef and dairy along with small areas of arable, farmed by a mix of small farming communities and those farmers operating large scale farms.

Figure 7.6 - Scoping Study Area for Land Use

One of the most important aspects of land-use in the southern and western part of the peninsula is the Castlemartin firing range which, covers approximately 5,900 hectares. The range is the only UK range available for direct-fire live gunnery exercises with both on-land impact areas and a large offshore safety area (Defence Estates, 2018). Merrion Camp is part of the Castlemartin training area and located to the north of the firing range.

Another key land-use in the Study Area is agriculture, with these areas primarily comprising grassland, pastoral land for sheep, beef and dairy along with small areas of arable, farmed by a mix of small farming communities and those farmers operating large scale farms.

Much of the coastal strip is made up of rough grazing, reflecting the designated sites and use of grazing for management purposes (Magic, 2018). Areas of woodland are found at Orielton and Stackpole, both part of the Pembrokeshire Bat Sites and Bosherston Lakes SAC.

7.6.4 Identification of Key Sensitivities and Potential Impacts

Table 7.11 (below) provides a summary of the potential effects arising from the proposed Project on those land use receptors identified above. The potential impacts will be defined further once final landfall, onshore cable route and onshore substation location has been confirmed. However, potential impacts have been scoped in or out on the information currently available. It has been assumed that the onshore cable route would be left in situ as and when the proposed Project is decommissioned to avoid any unnecessary disturbance or harm however this will be reviewed upon further decommissioning planning.

7.6.5 Potential Mitigation

Further investigation is required to establish the level of impact arising from the proposed Project on land use, excluding settlements, which have been scoped out. This will identify appropriate mitigation however the following will be implemented in the next phase of project development:

Liaison with a Land Agent to engage local landowners and identify the most appropriate route or location that will result in least disturbance or damage, taking account of the final selected infrastructure locations and routes of other proposed projects within the Study Area;

The proposed Project will be designed, and techniques chosen to avoid permeant impacts arising during construction, operation, and decommissioning;

Where possible a road route will be considered for the onshore cable route to reduce impacts on private landowners; and

Consultation will be undertaken with local landowners and communities to understand any future uses for land and ensure the Project limits potential adverse impacts on the land use in the study area.

7.6.6 Proposed Approach to Environmental Assessment

The potential impacts on land use in and around the proposed onshore infrastructure identified above will be further defined as the project design develops. Engagement with key onshore stakeholders (landowners, PCNPA, PCC, MoD) will also be undertaken, as defined in the Project Stakeholder Management Plan, to ensure that all local issues are discussed and, where appropriate, assessed fully via the EIA process.

The Scoping Opinion will also inform the approach to the EIA. The approach will be iterative the level of impact assessed through each stage.

Table 7.10 - Additional Data Required for Land Use

Data Requirement and Purpose	Data Collection Method
Confirmation of land use along the onshore cable route and at the onshore substation location to assess the significance of impact arising from the proposed Project.	Liaison with Land Agents, local landowners (including MoD and NT), PCC and PCNPA.
Review of the PCNPA Local Development Plan 2 and engagement with development teams at PCC and PCNPA to understand future aspirations for land use across the peninsula.	Review of published plans and engagement with the LPAs.

Table 7.11 - Key Sensitivities and Potential Impacts for Land Use

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Settlements	Disturbance or limiting development through the installation of onshore cable or siting of the substation.	Construction	No	It is not anticipated that landfall will affect any settlements. The onshore route will not pass through any settlements. The substation may be visible from parts of Pembroke Dock, this is considered further under Section 6.8.
Industrial	Disturbance or limiting development through the installation of onshore cable or siting of the substation.	Construction Operational	Yes	None of the preferred landfall sites are anticipated to directly impact on the operation of business, industry or energy sites. The onshore cable route and substation location have yet to be finalised and although it is not anticipated they would interfere with the operation of any identified sites a further assessment will be undertaken once the preferred route is confirmed.
National Park	Disturbance and damage to the special qualities of the Park affecting management, natural beauty, wildlife and cultural heritage.	Construction Operational Decommissioning	Yes	Until landfall, onshore cable route and location of the substation have been confirmed there is potential for impact on land use within the National Park boundary and further assessment is required to establish the significance of resulting effects.
Military	Potential disruption and restriction of terrestrial military operations arising from the installation of the onshore cable route.	Construction Decommissioning	Yes	Until landfall and the onshore cable route have been confirmed there is potential for an impact on military operations and further assessment is required to establish the significance of resulting effects.
Agriculture	The preferred sites for landfall would not affect agricultural land however disruption and disturbance may arise from the installation of the onshore cable route and siting of the substation, and depending on the selected substation location there could be	Construction Operational Decommissioning	Yes	Until the onshore cable route and location of the substation have been confirmed there is potential for an impact agriculture and further assessment is required to establish the significance of the resulting effects.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
	minor loss of agricultural land due to the development footprint.			

7.7 Traffic and Transport

7.7.1 Study Area

The Study Area for this section focuses on the onshore part of the Project Study Area, see Figure 7.7 The Study Area includes the proposed landfall options and surrounding road network, recognising the requirement for access during construction and potentially for maintenance works. The onshore cable route has not yet been finalised, however, it is anticipated that to the cable route will likely follow the local road network, at least in part, from the proposed landfall to the substation location.

In the absence of a final agreed onshore cable route, a strategic assessment of the road network has been undertaken for this Scoping Report and it is acknowledged that further assessments will be required once the onshore cable route is confirmed. The Study Area also includes the areas around the proposed onshore substation locations and the onward connection from the proposed substation to the grid connection at Pembroke Power Station.

It is the intention of the developer, BGW, to support the local supply chain. Working with the UK supply chain as much as possible, it is anticipated that larger components such as cables, plant, WTG and platform will be shipped into Pembroke Dock, with some assembly undertaken within the Port area before being shipped offshore. Port feasibility studies are being undertaken but will not be ready to inform this Scoping Report, although it is proposed that all primary components of the Project infrastructure, for example the blades and towers and platform will arrive by boat.

There may be elements of infrastructure delivered to Pembroke Port by road. Delivery of 400 kV substation plant, namely the 400 kV power transformer, may be classified at Abnormal Indivisible Load (AIL) and require specialist haulage equipment such as low loaders. A detailed assessment report will likely be undertaken including bridge assessment and swept path analysis. The final requirements will be known following confirmation of transformer supplier and hauler. A construction traffic management plan will be developed including mitigation measure to limit impact on the road network, however the impacts are expected to be temporary, short term and minor. Due to the uncertainty in respect of delivery to Pembroke Port more detailed planning will be required as the specifics of the proposed Project are finalised.

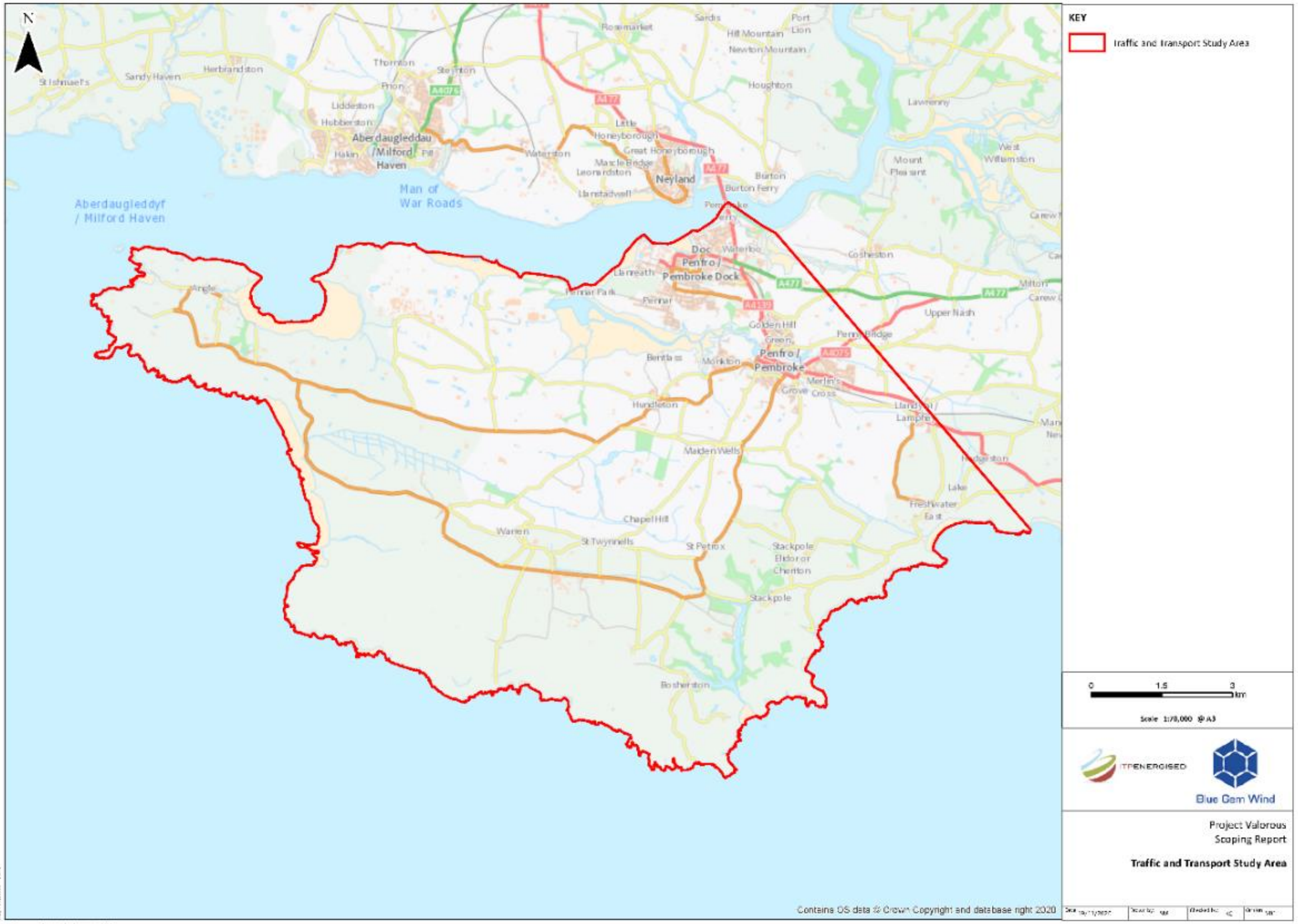
7.7.2 Baseline Data

This section has been informed by a desktop study utilising publicly available information, mapping and data. It has also been informed via initial pre-application consultation with key local stakeholders including MHPA, PCNPA and PCC.

7.7.3 Baseline Environment

The primary access route to the Study Area is via the A477, the main road from St Clears to Pembroke Dock. This route would service transportation to Pembroke Port, the proposed landfall and substation locations, and the proposed onshore cable routes.

Figure 7.7 - Scoping Study Area for Traffic and Transport



Access to the proposed onshore substation locations benefits from recent modifications made to the road network to provide a direct route for traffic to Pembroke Power Station. This route is from the A477, via the A4075, A4139 around Pembroke, turning onto the B4319 (utilising the new Maidenwell bypass), before joining the B4320, to the turn off at Wallaston Green. Continuing along the B4320 would provide access to Freshwater West, West Angle Bay, Angle Bay (Sawdern Point) and Angle Peninsula South Coast. More detailed analysis of potential routes for delivery of abnormal loads to the substation location during the construction phase, will be undertaken to ensure suitable access and identify any local mitigation or management measures that may be required.

The onshore cable route from Freshwater West, West Angle Bay and Angle Bay (Sawdern Point) and Angle Peninsula South Coast (potential landfall locations) will either be cross country or follow the road network. The options will affect the B4319 and B4320 and smaller access roads to Rhoscrowther and at Wallaston Green.

7.7.4 Identification of Key Sensitivities and Potential Impacts

The Institute of Environmental Assessment published the 'Guidelines for the Environmental Assessment of Road Traffic' (GEART) (1993), as guidance for the assessment of impacts of transport and traffic from new developments.

Further assessment under GEART will be required, however the guidelines provide a framework for assessment, which is considered in the following table, Table 7.12. The framework includes accidents and safety; driver delay and pedestrian severance. Indirect impacts associated with traffic and transport include noise and vibration, and impacts on local air quality. These are considered in Sections 7.10 and 7.11 of this report.

7.7.5 Potential Mitigation

The development of potential mitigation options will be an iterative process, developed as the proposed Project's final design is confirmed and as further assessments are undertaken to understand the significance of effects on local communities, pedestrians and other road users. Options such as scheduling work around busy times of year, to avoid coinciding with visitor traffic, and busy times of the day to avoid school times; utilising construction techniques to reduce the need for road closures; and the development of Construction Traffic Management Plan, are likely to be adopted.

7.7.6 Proposed Approach to Environmental Assessment

As discussed above, further assessment is required once the final Project designs are confirmed. Throughout the EIA process key stakeholders such as the Highways Authority, Pembrokeshire County Council (PPC), Pembrokeshire Coast National Park Authority (PCNPA) and local communities will be consulted with to inform the development of Transport Plans and mitigation options.

Table 7.12 - Key Sensitivities and Potential Impacts for Traffic and Transport

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Pedestrians, other road users and local communities	As a result of increased traffic there is potential for an associated increase in accidents and a reduced level of safety for road users and pedestrians.	Construction Operational Decommissioning	Yes	The potential for highway safety to be impacted may be significant and further assessment is required to understand the potential levels of traffic, duration of presence and the associated impact.
Pedestrians, other road users and local communities	Delays are likely to arise due to the installation of the onshore cable route	Construction Operational Decommissioning	Yes	The installation of the onshore cable route in the existing road network could cause significant delays and disruption. The road network from landfall to substation is predominantly narrow, in some places single carriageway, and although the area is not heavily populated it is a busy tourist destination. This consideration will be taken into account in the design iteration process for the onshore infrastructure, and further assessment will be required once the final onshore cable route is confirmed.
Pedestrians, other road users and local communities	Severance, of local communities to services and facilities may arise.	Construction Operational Decommissioning	Yes	The impact the Project would have will depend on the final onshore cable route and proposed landfall and substation locations. Further assessment is required once finalised to assess the level of impact.

Table 7.13 sets out proposed surveys to inform the EIA process.

Table 7.13 - Proposed Surveys to Inform the Traffic and Transport Assessment

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Desktop transport assessment to review existing condition	Within the onshore terrestrial Study Area	Summer 2022	The review would collect data on road status, main routes to be impacted, traffic movement and volumes to understand the level of impact on transport and traffic and develop mitigation.

7.8 Seascape, Landscape and Visual Impacts

7.8.1 Study Area

The Study Area for assessing potential effects on landscape, seascape and visual amenity from the offshore elements of the proposed Project (the WTGs), has been defined as a 45 km offset from the currently defined boundary.

This 45 km buffer is based on available literature - '*Visual Representation of Windfarms: Good Practice*' (SNH, 2017) recommends that for wind farms where turbines have a rotor tip of 150 m+ (as will be the case for this proposed Project). The initial Zone of Theoretical Visibility (ZTV) distance from the outer edge of the wind farm is 45 km. This is the distance at which WTGs could theoretically be visible, rather than the distance at which significant effects are expected.

There is also potential for visual impacts from the onshore substation. The maximum height of this element of the project will be approximately 15 m and the proposed footprint is currently estimated to be 210 x 180 m. The study area for the onshore visual impact assessment is as shown in Figure 6.1.

7.8.2 Baseline Data

The assessment is based on a desk top study utilising publicly available information and documents from the following sources:

- Pembrokeshire Coast National Park Local Development Plan (PCNPA, 2010);
- National Park Management Plan 2020 – 2024 and Special Qualities (PCNPA, 2019)
- Seascape Character Assessment (PCNPA, 2013a);
- Landscape Character Assessment (PCNPA, 2011b);
- Interactive Map (MAGIC, 2018);
- Registered Landscapes of Outstanding or Special Interest (Dyfed Archaeological Trust, 2018b);
- National Seascape Assessment for Wales (NRW, 2015b);
- Renewable Energy (PCNPA, 2011c);
- National Character Area Profile 159: Lundy (Natural England, 2013);
- Lundy, Strategic Planning and Policy (Devon County Council, 2018);
- The Pembrokeshire Coast Path (Visit Pembrokeshire, 2018);

- Gower Landscape Character Assessment (Gower Landscape Partnership, 2013); and
- Cumulative Impact of Wind Turbines on Landscape and Visual Amenity (PCNPA, 2013b).

7.8.3 Existing Environment

A key aspect of the existing environment in the context of Seascape, Landscape and Visual Impact Assessment (SLVIA) is the proximity of the Pembrokeshire Coast National Park to the offshore components of the proposed Project; and the fact that onshore components will likely lie within the PCNP boundary. The National Park Management Plan 2020 – 2024 (PCNPA, 2019) sets out the Special Qualities of the Park that contribute to sense of place and are:

- Accessibility;
- coastal splendor;
- cultural heritage;
- distinctive settlement character;
- diverse geology;
- diversity of landscape;
- islands;
- remoteness, tranquility and wildness;
- rich historic environment;
- richness of habitats and species;
- space to breathe; and
- the diversity of experiences and combination of individual qualities

Of the Special Qualities of the PCNP landscape and seascape are particularly significant. Further details on relevant Landscape Character Areas (LCAs) and Seascape Character Areas (SCAs) are provided below.

The Gower Area of Outstanding Natural Beauty (AONB) is approximately 88 km east of the proposed offshore array area. AONBs are designated under the Countryside and Rights of Way (CROW) Act 2000 for the purpose of conserving and enhancing the natural beauty of the area.

There are a number of designated heritage assets throughout the Study Area including scheduled monuments, listed buildings and conservation areas. While Section 7.5 deals with impacts on cultural heritage in its own right, this section considers the effects of development on landscape character, and the role that cultural heritage has in defining that character.

Much of the Pembrokeshire coast within the Study Area is defined as Heritage Coast and therefore protected through local planning policy. This is a non-statutory designation but highlights the value of the coast for its exceptional scenic quality, largely undeveloped land and features of interest.

South Pembrokeshire Heritage Coast, from Giltar Point to Angle Bay, is the closest to the offshore array area (~47 km) and potential landfall options Freshwater West and Bullslaughter Bay fall within this Heritage Coast. Lundy Island is also designated as Heritage Coast, as is the Gower Peninsula.

Table 7.14 and Figure 7.8 provides a summary of SCAs in and around the proposed Study Area. These SCAs were defined in Pembrokeshire Coast National Park Seascape Character Assessment, adopted 2013, as Supplementary Planning Guidance (PCNPA, 2013a).

Table 7.14 - Summary of relevant Seascape Character Areas in Study Area

SCA	Factors contributing to sensitivity
SCA26: Skokholm and Grassholm coast waters	• Remote, unspoilt rural coastline and island of importance for marine and island nature conservation and geological interest; • Historic character of the area and openness of the terrestrial landscape; • Focal points of headlands and islands; and • Pembrokeshire Coast Path as a sensitive receptor.
SCA27: Grassholm and The Smalls	• Simple, open, wild and remote character with views of the western coast and islands; • Forms part of the open setting for of the western coast and islands overlooked by the Pembrokeshire Coast National Park contributing to the sense of remoteness and wildness in these areas; • Marine and Grassholm nature conservation value; and • Pembrokeshire and Wales Coast Path as a sensitive receptor overlooking the area at a distance.
SCA29: Southern Inshore Waters	• The majority of the area is within the Pembrokeshire Marine SAC; • The area wraps around Skomer and Skokholm to the west forming an important part of their setting; • The area forms part of the unspoilt view from the western and southern coast, including from the Pembrokeshire Coast Path; and • Open sea area with unspoilt, simple, consistent and unified marine character at a vast scale and a significant sense of openness and remoteness.
SCA30: Southern Offshore Waters	• Small part in the Pembrokeshire Marine SAC; • Land would be apparent to the east and forms part of the unspoilt view from the southern coast, including from the Pembrokeshire Coast Path; and • Open sea area with unspoilt, simple, consistent and unified marine character at a vast scale and a significant sense of openness, tranquility and remoteness.
SCA31: Outer Milford Haven	• Remote, unspoilt cliffs and sheltered bays and estuaries; • Popular recreational destinations such as Dale; • Nature conservation interest especially around Dale; • Richness of military and nautical history; and • Pembrokeshire Coast Path as a sensitive receptor.
SCA32: Inner Milford Haven	• Historic character of older urban settlements and villages, historical features and key views such as to and from Pembroke Castle; • Use by recreational boats who can be sensitive receptors; • Close association with Daugleddau river system, of nature conservation and recreational importance; • Nature conservation importance of wetlands and mudflats; • Pembrokeshire Coast Path as a sensitive receptor; and • Large numbers of urban receptors and passing traffic for example on Cleddau Bridge.
SCA34: Freshwater West	• Remote, unspoilt sweep of beaches and dune system with craggy cliffs; • Wide views across bay and to focal points such as St Ann's Head;

SCA	Factors contributing to sensitivity
	• Tranquility when no firing on ranges; • Important recreational destination; and • Pembrokeshire Coast Path as a sensitive receptor.
SCA35: Castlemartin Coastal Waters	• Remote, wild, exposed coastline; • Spectacular indented cliffs with numerous features such as arches, stacks and caves; • Significant nature conservation and archaeological interest; • Military range; • Commercial shipping and ferries on route to Milford Haven to the west; • Openness and sustained sea views, including views on clear day to Lundy Island; and • Pembrokeshire Coast Path is a sensitive receptor.
SCA36: Stackpole Coastal Waters	• Steep indented coastline with cliffs and coves forming a natural coastal edge; • Rural pastoral character of the hinterland and dunes, with very limited built form; • Pembrokeshire Coast Path as a sensitive receptor; • Nature conservation interest of coast, grassland and dunes; • Special relationship between Bosherston Lakes inland with Broad Haven beach; • Distinctive, historically important Stackpole Warren dune system; • Wide, unspoilt views from the headlands to open sea and along the coast and channeled views such as from Broad Haven beach to Church Rock; and • Feeling of tranquility in places especially out of season, away from the Castlemartin range.

NRW has also produced an assessment of Marine Character Areas (MCAs) in their publication National Seascape Assessment for Wales (NRW, 2015b).

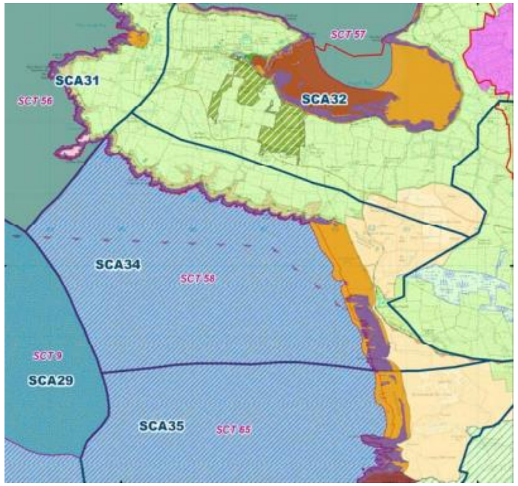
Table 7.15 - Summary of relevant Marine Character Areas in Study Area

MCA	Aesthetic Qualities
MCA21: Milford Haven	The ria forms a unifying theme between the 2 distinctly contrasting characters of the enclosed upper stretches in the east and the open body of water in the west. Inland, the intricate river systems of the upper ria are highly regarded for their scenic rural beauty – the sinuous waterways, inlets, bays and side creeks are a haven of tranquility. As the ria widens, the levels of tranquility reduce and human activities increase. The majority of vessel movements are around Pembroke Dock, Milford Port, and the marinas at Neyland and Milford – here the waterway becomes very busy as large oil tankers, jetties and dock apparatus, and industrial buildings hum with activity (and associated night-time lighting). Exposure is greatest at the mouth of the estuary and on the elevated headlands. Here the full force of the prevailing southwesterlies blowing in off the Atlantic can be felt, battering the coastline on a stormy day. The doglegged feeder channels provide shelter and a contrasting feeling of calm, which increase as one travels further through their inland courses. There is a prevailing sense of shelter within

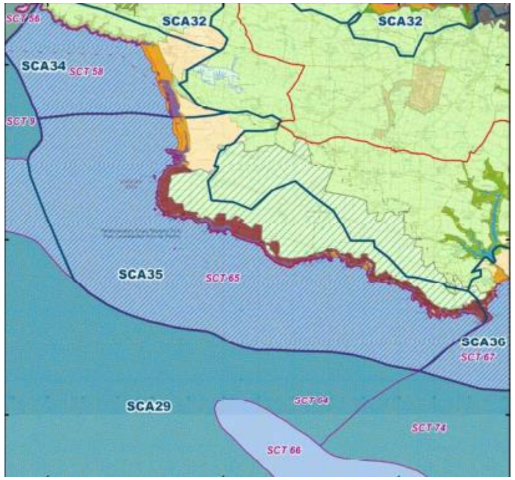
MCA	Aesthetic Qualities
	the rural upper reaches of the ria with a strong sense of naturalness and tranquility.
MCA22: South Pembrokeshire Coastal & Inshore Waters	Views from the sea and from headlands along this predominately unsettled coastline are key to how this area is experienced, with red sandstone cliffs and white limestone cliffs creating areas of distinct character and a dramatic backdrop. The prominent local landmarks of Manorbier Castle and Well Chapel are located on these low cliffs, forming historical features when viewed from the sea. The headlands of St Govan's Head, Stackpole Head and Old Castle Head act as visual markers for sea users, usually as places to be avoided due to the difficult sea conditions they create. Wide uninterrupted views can be gained out to sea and along the coast with important views to and from Caldey Island (MCA 24), including views to Lundy Island and the north Devon coast via the Bristol Channel (MCA 28). These include distant glimpses of the hills of Exmoor National Park and the cliffs of the North Devon AONB. Feelings of tranquility and remoteness are strong away from the coastal car parks and beaches and when the firing ranges are not in use. The MCA can become very exposed on headlands, including at Castle Head where the full force of westerlies are felt. Rough seas are also experienced offshore at Turbot Bank and over St Gowan Shoals, creating a sense of danger, foreboding and being at the hands of nature. The open sea forming the transitional border with MCA 23 creates a simple, consistent and unified marine character at a vast scale, evoking a significant sense of openness, remoteness and exposure.
MCA23: South Pembrokeshire Open Waters	The rugged coastline of Pembrokeshire Coast National Park (backing MCA 22) forms a dramatic backdrop to the eastern half of the MCA – including the outlines of prominent limestone headlands such as St Govan's Head and Stackpole Head. The structures and associated lights from coastal development, including the tall refinery chimneys and flares at Milford Haven (MCA 21), can diminish an overriding sense of remoteness. These qualities can also be diminished during live firing from the MoD bases at Castlemartin and Manorbier, whilst the sounds and movements of the sea form dominating naturalistic factors for the majority of the time. The southern and western extents of the MCA have limited visibility with the adjacent coastlines; mainly influenced by the movement of large vessels approaching Milford Haven and travelling along the Bristol Channel (MCA 28). When marine transport is absent a pervading sense of isolation, exposure and wildness takes over. The MCA forms a strong maritime setting to the Pembrokeshire Coast National Park to the north, as well as acting as a distant backdrop to views from Lundy Island and the North Devon coast (including North Devon AONB and Exmoor National Park). Caldey Island creates a characterful seascape feature in the east, marking the entry into Carmarthen Bay (MCA 24). Views to Gower AONB, including the distinctive form of Worm's Head (MCA 25), also feature in eastward vistas to frame this open marine area.

Figure 7.8 - Seascape Characteristic Areas (PCNPA, 2013)

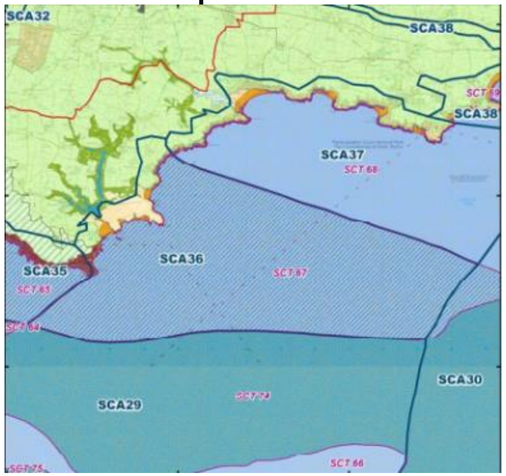
No.34 Freshwater West



No.35 Castlemartin Coastal Waters



No.36 Stackpole Coastal Waters



No.37 Freshwater East and Manorbier

There are 6 Registered Landscapes of Outstanding or Special Interest in the Study Area: Stackpole Warren (46 km from the offshore array); Milford Haven Waterway (approx. 46 km from the offshore array); Manorbier (approx.. 58 km from the offshore array); Skomer Island (35 km from the offshore array); Taf and Towy Estuary (85 km from the offshore array); and St David's Peninsula and Ramsey Head (46 km from the offshore array). These are localised character areas, defined by the Welsh Archaeological Trusts, and concerned with how historic land management has led to landscape character.

Lundy Island is 66 km to the southeast of the offshore array area and is described by Devon County Council in their local character assessment and in Natural England's National Character Area profile 159 Lundy (2013): "*Rugged cliffs… heathland / grassland mosaic with an open, windswept feel and views across the sea… sense of isolation… Lundy has one village.*"

With respect to LCAs, details are provided in Table 7.16.

Table 7.16 - Summary of relevant Landscape Character Areas in Study Area

LCA	Characteristics
LCA6: Castlemartin/Merrion Ranges	• A very exposed broad expanse of rolling lowland with associated coastal cliffs. The area is largely occupied by the MoD for national defence purposes for both live fire and dry military training; • This area is gently undulating grassland on an exposed coastal plateau on the southern tip of Pembrokeshire. The area has a low level of built development yet is characterised by evidence of former quarries and scattered villages and a strong military influence on range areas to the north and west of the Aspect Area; and • There is a series of rocky cliffs and steep slopes with some small sheltered coves on the south coast. The cliffs contain fewer sharp indentations than cliffs elsewhere in the National Park and feature high levels of cliff-top coastal grassland.
LCA7: Angle Peninsula	• A peninsula of rolling lowland and associated coastal land with low cliffs and a stretch of low estuarine frontage on the south side of the outer part of Milford Haven, at Angle Bay; • The area contains some exposed hill tops with scattered farmsteads in an agricultural landscape. The open landform and borrowed coastal views of indented cliffs and slopes give the area a strong coastal feel, especially to the west; and • There is a high incidence of traditional cottage buildings in Angle village and a distinctive local linear field pattern. Views over Milford Haven Waterway to the oil refineries and installations creates a visual detractor but views to West Angle Bay and over to St Ann's Head are attractive.
LCA8: Freshwater West / Brownslade Burrows	• An area of rolling lowland, almost devoid of settlement, with associated coastal areas of fixed sand dunes, low sea cliffs and bays; and • The landscape is characterised by a distinctive gently undulating open area dominated by sand dunes backed by marshy fields at the western end of Castlemartin Corse. The close visual and sensory association with the coast adds to the sense of place, especially when strong southwesterly winds blow and raise a

LCA	Characteristics
	high surf along the broad sweep of exposed beach and rocky foreshore.
LCA9: Marloes Peninsula	• A large broad promontory, with rolling lowlands, associated coastal fringe, sea cliffs to the north west and south along St Ann's Head, and estuarine land along the north shores of Milford Haven; • Large tract of agricultural landscape with villages and farmsteads. Views of the coast and the disused airfield at Talbenny add a sense of place.. • Views of the offshore islands of Skomer and Skokholm to the west and views of South Hook LNG are a feature of the eastern section.
LC10: Skomer and Skokholm	• 2 islands a short distance from Marloes, rising to 79 m and 40 m AOD, separated by Broad Sound and waters around Skomer and Marloes Peninsula are designated as a Marine Nature Reserve (MNR); and • Skomer and Skokholm are very attractive islands, rich in natural vegetation with coastal grassland and scrub, due to low levels of agricultural management. Being un-spoilt nature adds to the scenic value of the area, offering panoramic views.

There are a number of National Nature Reserves (NNRs) within the Study Area; although these are not designated specifically to protect the landscape, they are likely to attract visitors whose views could be affected by the proposals. Stackpole NNR is the closest to the offshore array area at approximately 48 km.

7.8.4 Potential Mitigation

Potential mitigation that may be appropriate to implement to reduce significance of any SLVIA impacts include:

- As far as possible, when also considering engineering and wind resource issues, seek to position the WTGs within the offshore array area in a way that minimizes any visual impact issues from land, which may include WTG size, height, location, orientation, array layout and lighting;
- Use appropriate, industry-standard paint colours for WTGs;
- Ensuring potential visual impacts are considered in the final site selection process for the onshore substation; and
- Sensitive design / screening of the final onshore substation.

7.8.5 Identification of Key Sensitivities and Potential Impacts

Table 7.17 provides a summary of the potential effects arising from the proposed Project (offshore, landfall and onshore components) on seascape, landscape and visual receptors.

Table 7.17 - Key Sensitivities and Potential Impacts for Seascape, Landscape and Visual Impacts

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Landscape Character of the PCNP	Adverse impact on landscape character of the PCNP from offshore WTGs and onshore substation.	Construction Operational Decommissioning	Yes	The study area has a high number of sensitive visual receptors. The EIA will need to carefully assess potential impacts.
Character of Registered Landscapes of Outstanding or Special Interest	Registered Landscapes of Outstanding or Special Interest lie in close proximity to proposed works.	Construction Operational Decommissioning	Yes	The EIA will need to carefully assess potential impacts on Registered Landscapes of Outstanding or Special Interest.
Regional Seascape Character	WTGs and associated offshore infrastructure would be new features in the seascape.	Construction Operational Decommissioning	Yes	The EIA will need to carefully assess potential impacts on SCAs due to sensitivity of these and the relatively unspoilt nature of the seascape off Pembrokeshire.
Users of the Pembrokeshire Coast Path and other PRoWs.	Adverse impact on visual amenity via all project phases.	Construction Operational Decommissioning	Yes	Users of the coast path and other PRoWs in the study area will be highly sensitive to visual impact as the existing, mainly undeveloped nature of this coastal area is one of the main reasons that users visit this area.
Heritage Coast: South Pembrokeshire; and Marloes and Dale	Installation and removal of infrastructure directly impacting features from cable	Construction Operational Decommissioning	Yes	Potential damage and loss of features.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Other coastal users, including beach / recreational users	Adverse impact on visual amenity via all project phases.	Construction Operational Decommissioning	Yes	Local beach users / recreational users may be sensitive to visual impacts and as such, detailed assessment will be required in the EIA.
Local residents	Adverse visual impact via construction works and final project infrastructure (WTGs offshore; onshore substation).	Construction Operational Decommissioning	Yes	Even though the study area has relatively small settlements and a small population level, when compared to other parts of Pembrokeshire, an assessment of potential visual impacts will still be required in the EIA.
Visitors to Lundy Island	Visual impact on seascape for visitors to Lundy Island.	Operational	Yes	Visitors to Lundy Island may visit to experience the clear seascape that exists around the Island. Scope for this to be affected by the WTGs will need to be assessed within the EIA.
Landscape Character of Gower AONB	NA	Operational	No	The Gower AONB is a highly sensitive receptor due to being designated for landscape. However, it is 87 km from the offshore array so significant effects on this AONB are not expected.

Table 7.18 - Additional Data Required for Seascape and Landscape Visual Impact Assessment

Data Requirement and Purpose	Data Collection Method
ZTV (to refine the SLVIA study area)	Digital ZTV produced using GIS.
Photographs from key viewpoints (to be agreed with PCNPA / PCC) in order to assess views of key receptor groups.	Site visit by landscape architect / SLVIA consultant.
Photomontage of WTGs (to assess what WTGs and onshore substation may look like from representative view points).	Photos from site visit and WTG parameter values to be provided by BGW.
Cumulative WTG ZTV (to assess cumulative effects).	Obtain location and heights of other existing or proposed WTGs from PCNPA / PCC. Produce digital ZTV to show where cumulative effects could occur.

7.8.6 Proposed Approach to Environmental Assessment

In preparing this section, reference has been made to key guidance documents, including:

- Guidelines for Landscape and Visual Impact Assessment 3rd Edition (GLVIA) (Landscape Institute / IEMA, 2013);
- Visual Representation of Development Proposals Technical Guidance Note 06/19 (Landscape Institute, 2019);
- Visual Representation of Windfarms: Good Practice (SNH, 2017);
- LANDMAP Guidance Note1: LANDMAP and Special Landscape Areas (NRW, 2017);
- Planning Inspectorate Advice Note Nine: Rochdale Envelope, Version 3 (PINS, 2018)
- Offshore Wind Turbine Visibility and Visual Impact Threshold Distances (Sullivan *et al.*, 2013); and
- NRW commissioned Evidence reports on seascape and visual sensitivity to offshore wind farms (NRW, 2019).

LANDMAP is the formally adopted methodology for landscape assessment in Wales, and NRW expects all landscape impact assessments in Wales to apply the use of LANDMAP. PCNPA has produced the Pembrokeshire Coast National Park Landscape Character Assessment, which analyses LANDMAP within the National Park, and was adopted in 2011 as Supplementary Planning Guidance (SPG) (PCNPA, 2011b). This character assessment has therefore been used to inform the landscape baseline within the National Park area.

A full SLVIA will be undertaken in line with GLVIA. Effects on landscape / seascape character and on visual amenity will be assessed and presented separately in the final SLVIA. The assessment of effects on landscape / seascape character will involve an analysis of existing character assessments as well as a site visit by a landscape architect to confirm the validity of these assessments and identify the character areas which may be affected.

The assessment of effects on visual amenity will involve the production of a Zone of Theoretical Visibility (ZTV) to accurately define the SLVIA study area, by indicating the areas from which the proposed development could theoretically be visible. Landscape architects will also visit the site to assess key viewpoints from within the ZTV. These viewpoints will be agreed in in advance with PCNPA / PCC at the start of the SLVIA process. Consultation will also be held with Local Planning Authorities that cover the Gower and Lundy areas to determine if viewpoints are required in these areas, subject to the outputs of the ZTV process.

For selected key views, verified photomontages will be produced so that representative visual representation of the proposed WTGs can be provided. A worst-case scenario in terms of maximum WTG blade tip height will be used as the basis of the assessment. Within the ES, a full photomontage will be produced to demonstrated what the offshore array could look like from different terrestrial vantage points.

The assessment will also take into account any cumulative impacts of the WTGs in conjunction with any other OWF (PDZ), or other structures with high vertical elevation, in line with the guidance document '*Cumulative Impact of Wind Turbines on Landscape and Visual Amenity*' (PCNPA, 2013b).

As for the WTGs and offshore project components, for the onshore substation, a worst-case scenario will be assessed in term of dimensions, including height. Viewpoints and photomontages may also be required to assess this project element, subject to feedback in the formal Scoping Opinion and via consultation with PCNPA / PCC at early stages of the SLVIA process.

7.9 Underwater Noise and Vibration

7.9.1 Study Area

The Study Area for the subsea noise assessment will cover the offshore Project Area, as presented in Figure 2.1. The final route for the export cable has not yet been selected, therefore, for the purposes of this report, the area encompassing all possible cable route options and the offshore array area have been considered.

7.9.2 Baseline Environment

There is a variety of noise sources which occur within UK territorial waters, both natural and anthropogenic. Natural noise sources include wind and wave action, fish and marine mammal species vocalisations, and geological events such as earthquakes. Anthropogenic sources include land-based construction noise transmitted through the seabed, vessel noise, at-sea seismic surveys, and the use of fishing and navy sonar. The nature of the seabed bathymetry, sediments, and hydrodynamics will affect how quickly and easily any noise generated in the area will travel.

To identify noise sensitive receptors and noise sources present within the Study Area, this section has utilised information from:

- Chapter 4 (Project Description); and
- Chapter 6 (Biological Environment and Nature Conservation).

A detailed description of baseline subsea noise will be provided fully during the EIA.

7.9.3 Identification of Key Sensitivities and Potential Impacts

The main source of underwater noise and vibration during construction works is created from percussive piling or drilling. For this proposed Project, it is anticipated that impact piling and/ or drilling may be required for the installation of the offshore substation. Whilst not the preferred option anchor installations, there is potential for suction piles or drilled piles dependent on site specific ground conditions (see Section 4, Project Description).

It is noted in the Project Description (Section 4) that drilling is more likely to be used than piling, due to the anticipated ground conditions. However, both activities have been scoped in for the purpose of this assessment. It is important to scope in piling at this stage because impact piling typically creates higher intensity underwater noise and vibration emissions than drilling.

Noise from piling/drilling can be characterised as being of moderate to high intensity. The source level of pin piling has been shown to exceed 200 dB (e.g. Bailey *et al.,* 2010), whereas noise from drilling may be considerably lower (e.g. a source level of 162 dB, as reported by Nedwell and Brooker (2008)). The exact source levels will depend on the specifications of the equipment used (e.g. pin pile diameter and hammer; drilling equipment) and the environmental conditions such as ground conditions.

Piling/drilling may be required to secure the offshore substation infrastructure. The duration of the pin piling/drilling will vary depending on the technique used. The maximum number of piles/drilled locations will be four. At a very high level, it is estimated that piling would last between 10 and 15 hours per location, and drilling would last up to 40 hours per location, though these values will be confirmed through detailed design. Using these high-level estimates, the maximum duration of piling/drilling associated with construction is 160 hours. It is noted that these hours will not be continuous as it does not account for the set-up time of the activity. It can therefore be reasonably assumed that the piling/drilling activity will have a limited temporal extent, which reduces the likelihood of disturbance to sensitive marine receptors. In summary, underwater noise and vibration emissions are expected to be very low for the majority of the construction phase of the project, with the exception of moderate, short-term emissions during piling/drilling for installation of the offshore substation.

Other noise sources arising from construction activities include vessel movements, installation of anchors, seabed preparation, cable installation and preparation, cable snapping/vibration and cable protection. Furthermore, noise and vibration may depend on the preferred method for cable installation at the final landfall site, e.g. if HDD is required. There is also the possibility that UXO detonation may be required.

During the operational phases of the Project, noise sources will be largely restricted to noise generated from operational WTGs, cable 'snapping', and limited vessel movements.

Table 7.19 - Key Sensitivities and Potential impacts for Underwater Noise and Vibration

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Ecological receptors, such as marine mammals and fish.	Disturbance to behaviour patterns, masking, hearing threshold shift, physical injury and physiological changes	Construction Operation Decommissioning	Yes	The majority of noise emissions from the Project are expected to produce noise and vibration levels that are not significant. Underwater noise emissions from any potential piling activity cannot be excluded from giving rise to potential significant effect at this stage. Underwater noise and vibration impacts on ecological receptors can be adverse and further assessment of all noise impact pathways is required to understand the significance of potential sources.

7.9.4 Potential Mitigation

Offshore construction would follow best practice measures to limit the impacts of noise on sensitive receptors, such as adhering to the JNCC's guidelines on mitigation measures for geophysical surveys (JNCC, 2017) and UXO detonation (JNCC, 2010). The mitigation implemented will be proportionate to the predicted level of effect on ecological receptors, as assessed in the EIA, which will adhere to the latest guidance to apply relevant thresholds / criteria (e.g. Popper *et al.*, 2014; NMFS, 2018; Southall *et al.,* 2019).

With regards to piling/drilling, the principal of Best Available Technique BAT will be incorporated when defining the offshore substation installation method (JNCC, 2010) where possible. Specifically, the technique to be used will create the minimum amount of impact (based on noise level/duration), whilst ensuring that it can meet the required piling/drilling depths, and without excessive cost.

7.9.5 Proposed Approach to Environmental Assessment

All potential noise sources arising during the project life cycle will be characterised in terms of their likely sound level, frequency, and duration. This information will likely be obtained through desk based assessments as well as underwater noise modelling. With regards to underwater noise emissions from piling/drilling, information found through the desk-top study may be supplemented by information provided the project-specific equipment manufacturers.

The primary concern with regards to the production of underwater noise is the effects of increased noise on sensitive marine ecological receptors, primarily marine mammals and fish. As subsea noise is readily transmitted underwater, there is potential for sound and vibration emissions to adversely affect these receptors.

With regards to the anticipated low-level impact pathways (i.e. all except UXO detonation and piling/drilling), a desk-based assessment of the potential impacts, impact ranges and population-level effects on marine receptors will be undertaken during the EIA process.

Should piling be required, computational modelling of the underwater noise emissions will be undertaken. This will be used to determine the impact zones associated with this activity, and consequently the population-level effects. The modelling approach and thresholds to be used will be agreed with the regulators and key stakeholders.

Should drilling be required, the requirement for project-specific noise modelling will be discussed with regulators and key stakeholders, noting that drilling typically produces significantly lower source levels than piling.

Should UXOs be discovered in the project area and are required to be detonated as part of the project, a more detailed consideration of underwater noise modelling will be required. As above, the modelling approach and thresholds to be used will be agreed with the regulators and key stakeholders.

The approach to the EIA and data gathering will be informed by the above assessment methods and discussions with the regulators and key stakeholders.

The EIA, where appropriate, will be supported by, and include:

- A review and assessment of the potential noise and vibration effects of FLOW renewable energy devices on marine fauna (with specific reference to FLOW projects such as HyWind and Kincardine which have undertaken EIA studies), including assessment of subsea noise effects of similar technology to that planned to be deployed on this proposed Project;

- A desk-based review of the latest available evidence on the hearing sensitivities and potential effects on benthic invertebrates, marine reptiles, seabirds and diving bird species; and
- Underwater noise modelling.

It is anticipated that most underwater noise sources from the project will produce noise and vibration levels do not give rise to significant effects. Underwater noise assessments will determine the potential zone of masking prior to the assessment. Some impact pathways, namely UXO detonation and piling/drilling, have the potential to produce significant noise levels, though these will occur over limited time scales (and in the case of UXO detonation, may not occur at all). Therefore, due to the overall limited noise pathways associated with the project as a whole, no project-specific subsea noise surveys are proposed to characterise the site for EIA purposes.

7.10 Airborne Noise and Vibration

7.10.1 Study Area

The Study Area for this assessment is shown in Figure 2.1 and covers offshore and onshore project areas, including the preferred options for landfall, onshore cable routes and onshore substation locations.

The offshore array is located approximately 45.8 km southwest from the coast of Pembrokeshire. Onshore, the proposed Project design is not yet finalised but potential landfall options include Angle Bay, West Angle Bay, Freshwater West beach and Angle Peninsula South Coast, with the onshore route from landfall to the onshore substation. The onshore substation is anticipated to be located in close proximity (within 2 km) to the existing Pembroke Power Station.

Although very rural in nature, the onshore Study Area is bordered by the MoD Castlemartin firing range to the east, Valero oil and gas refinery to the west and Pembroke Power Station to the east.

7.10.2 Baseline Data

This assessment is informed by a desktop study (utilising OS mapping, Google aerial maps and Local Development Plan maps) supplemented by a site reconnaissance walkover in summer 2020, to identify existing noise sources and potential receptors sensitive to increased levels of noise or vibration.

7.10.3 Baseline Environment

Across most of the Castlemartin peninsula, where onshore works will likely be located, ambient noise level is limited to local road noise and birdsong, except when firing at the nearby Castlemartin MoD range is underway. There is also significant background industrial noise in the vicinity of the Valero refinery and Pembroke Power Station.

The largest urban areas close to the proposed onshore works are Pembroke Dock, and Pembroke to the east of the study area. Residential properties are otherwise focused in small villages, such as Angle, or hamlets, such as Rhoscrowther. Out with these residential areas, small farms and pockets of houses are located sporadically across the peninsula.

The peninsula also falls within Pembrokeshire Coast National Park, with much of the coast designated as SSSI or SACs and bordered by the Wales Coast Path. The area is popular with tourists and is an important destination for visitors.

Offshore, airborne noise is limited to that generated by commercial shipping that transits through this region, to and from Milford Haven and also ambient noise generated by metocean conditions.

7.10.4 Identification of Key Sensitivities and Potential Impacts

Given the distance of the proposed WTGs from shore it is considered that there would be no impact on any onshore receptors via airborne noise generated by these Project components.

Therefore, it is proposed to scope out the impact of airborne noise from any aspect of the offshore works.

The potential remains for construction and decommissioning of both landfall and onshore works to generate airborne noise and impact on sensitive receptors. Operational noise is likely to be limited to the substation. Although this will be in the close vicinity of the existing Pembroke Power Station and the baseline noise environment will therefore include industrial noise from that source, there is potential for operational noise from the Project substation to impact on local sensitive receptors, if present. Therefore, it is proposed that airborne noise from onshore (and landfall) works be assessed fully in the EIA.

7.10.5 Potential Mitigation

Onshore construction and decommissioning works will adhere to best practice and industry guidance to reduce airborne noise and vibration. Other measures such as timing of works will be considered and applied where possible.

Airborne noise and vibration arising from onshore operation, primarily of the substation, will be reduced through careful design, siting, use of technology and the installation and operation of acoustic barriers. This strategy will be developed following further assessment for the EIA.

7.10.6 Proposed Approach to Environmental Assessment

Further work is required to identify and assess impacts from airborne noise and vibration arising from any onshore (and landfall) works.

A detailed desktop study will be undertaken, supported if necessary, by a baseline noise survey in the area of proposed works. This study will list and define all key receptors. Any further assessment will be informed by the Scoping Opinion and further discussions with relevant stakeholders, including NRW and the LPA. The exact scope of this more detailed assessment will also be developed further once the preferred location of all the onshore works is known as the final preferred location(s) may have more / less scope for airborne noise impacts than other locations.

Table 7.20 - Key Sensitivities and Potential impacts for Airborne Noise

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Onshore Ecological Receptors	Disturbance to behaviour patterns including nesting, roosting foraging and breeding arising from the installation of the onshore cable (including landfall) and onshore substation.	Construction Operational (substation only) Decommissioning	Yes	Onshore construction, operational and decommissioning phases have the potential to create noise and disturb ecological receptors including birds, bats and otters. As the onshore elements have yet to be finalised further assessment will be required to establish the significance of the effect.
Onshore Human Receptors	Noise disturbance arising during all phases of the project to onshore receptors such as residential areas and sensitive sites in the National Park.	Construction Operational (substation only) Decommissioning.	Yes	Onshore construction, operational and decommissioning phases have the potential to create noise and disturb human receptors such as residential areas, tourist destination and the Wales Coast Path. As the onshore elements have yet to be finalised further assessment will be required to establish the significance of the effect.
Offshore Ecological and Human Receptors	Noise disturbance arising during all phases of the project to offshore receptors.	Construction Operational Decommissioning.	No	Limited airborne noise is predicted to be generated at any stage of the proposed Project; and there are also limited sensitive receptors to airborne noise in the offshore environment.

7.11 Air Quality

7.11.1 Study Area

The extent of the air quality Study Area is shown below. Exact locations of cable landfall, onshore cable route and onshore substation are not yet finalised but all these project elements will be sited within the Study Area shown below. Definition of the air quality Study Area has followed the Institute of Air Quality Management (IAQM) guidance (IAQM and EPUK, 2017) and includes the area within 350 m of any onshore construction works, within which construction phase air quality (dust) impacts may be experienced. The Study Area may therefore be reduced when the onshore construction areas are known.

Figure 7.9 including the 350 m Buffer Area from Potential Onshore Construction Works. The air quality Study Area has also followed Highways Agency guidance (Highways Agency, 2007), and will also include areas within 200 m of roads predicted to experience an increase in traffic flows.

7.11.2 Baseline Data

The study is desktop based and uses publicly available monitored pollution data collected by Pembrokeshire County Council (PCC) (Pembrokeshire County Council, 2019).

7.11.3 Baseline Environment

7.11.3.1 *Air Quality Management*

In the commercial main street areas of Haverfordwest and Pembroke, PCC has declared statutory Air Quality Management Areas (AQMAs) for exceedances of the annual mean nitrogen dioxide (NO_2) objective. Road traffic is the principal contributor of emissions, as both the locations are subject to the "*canyon effect*", where are high sided buildings on either side of a narrow road results in a low available dispersion of the local air. The Haverfordwest AQMA is located over 8 km northeast of the air quality Study Area and is not anticipated to be affected by the development. The Pembroke AQMA is within the air quality Study Area.

7.11.3.2 *Air Quality Monitoring*

Under the Local Air Quality Management (LAQM) regime, PCC carries out automatic and passive air quality monitoring. The methods employed for monitoring include passive diffusion tubes, active samplers and real-time automatic analysers. The nearest automatic air quality monitor is located at Narberth and is operated by Defra as part of the Automatic Urban and Rural Network (AURN). It is located approximately 17 km northeast of the air quality Study Area.

The 2019 Progress Report (PCC, 2019), which is the latest publicly available Local Air Quality Management report for PCC, states that diffusion tube monitoring is undertaken where there are concerns over public exposure to pollutants from road vehicles. The monitoring is mainly focused around Haverfordwest and Pembroke. As Pembroke is potentially located within the Project Area, the monitoring data from this area were evaluated to provide an overview of air quality. Monitoring data for 2014 – 2016 are detailed in Table 7.21.

Figure 7.10 - Extent of Air Quality Study Area, including the 350 m Buffer Area from Potential Onshore Construction Works

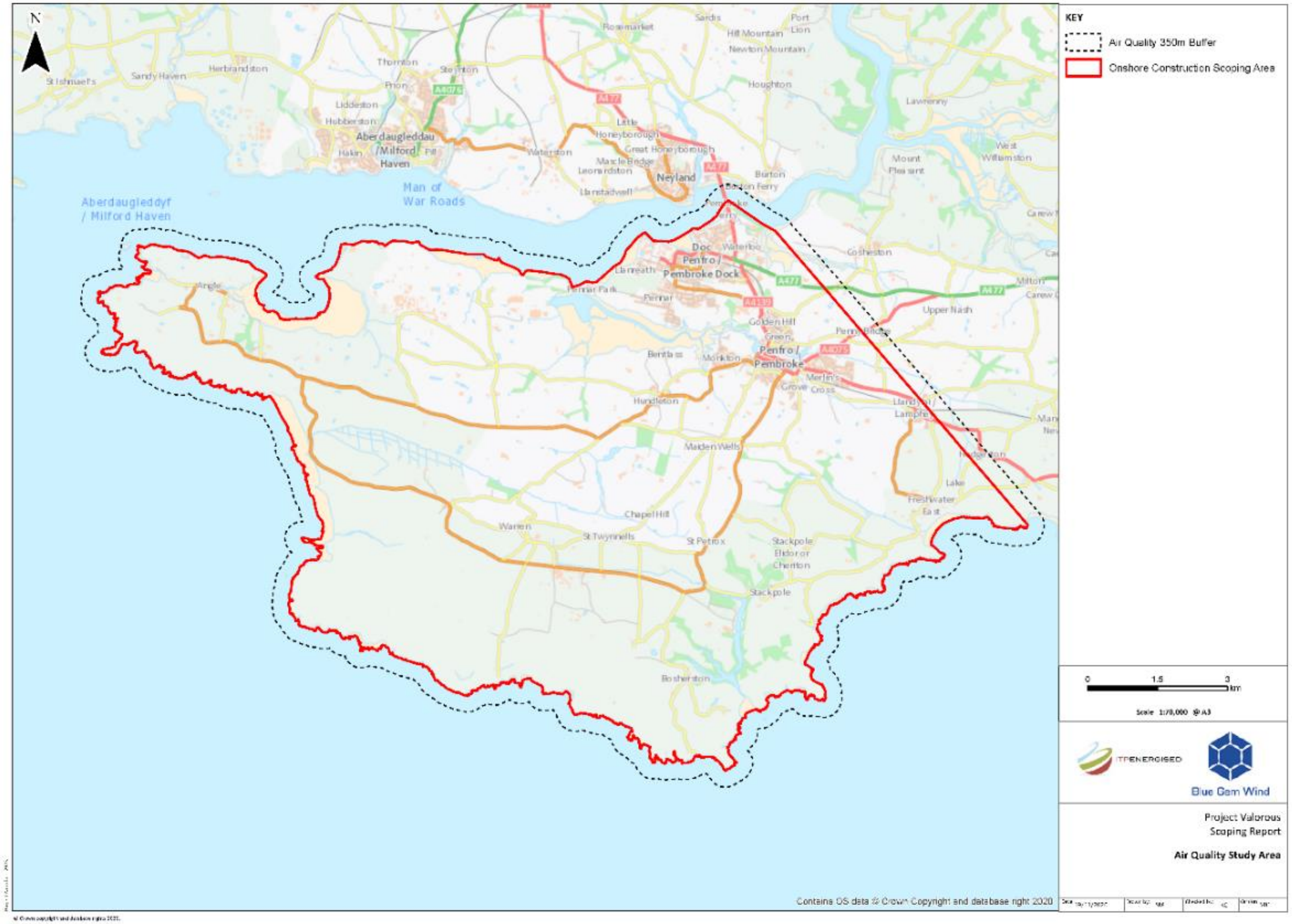


Table 7.21 - Pembroke Air Quality Monitoring Data 2014-2016

Tube Location ID	AQMA	Annual Mean NO_2 level (µg/m^3)		
		2014	2015	2016
PCC40 (Main St Pembroke)	No	28.3	22.2	21.9
PCC41 (Main St Pembroke)	Yes	37.9	25	25.4
PCC42 (Main St Pembroke)	Yes	41	25.3	22.4
PCC43 (Main St Pembroke)	Yes	47.8	32.2	34.2
PCC44 (Main St Pembroke)	Yes	33.7	37	36.6
PCC45 (Main St Pembroke)	Yes	29	41	44
PCC47 (Main St Pembroke)	No	26.8	24.6	26.4
PCC48 (Main St Pembroke)	No	16.2	14.3	14.2

As detailed in Table 7.21, NO_2 concentrations between 2014 and 2016 were above the annual mean objective (40 µg/m^3) at several locations.

Automated analysers were introduced in 2010 at Pennar Cants to monitor air quality at Pembroke Power Station. However, in 2016 Pembroke Council stopped the monitoring of the area due to consistently low results.

7.11.3.3 *Identification of Key Sensitivities and Potential Impacts*

Offshore

Air quality and particulate matter (as indicated by concentrations of gases which are potentially harmful to human health) is not generally considered to be an issue for offshore developments (Fuzzi *et al.*, 2015). The main concerns over air quality come from sources of combustion products onshore and are related to emissions from road transport and land-based industry (Defra, 2011). Potential air quality pressures from the offshore elements of the proposed Project will primarily occur from engine exhaust emissions from marine vessels used during installation and maintenance. It is proposed that given these emissions will be emitted in the coastal or offshore environment, away from any major terrestrial emission sources, the emissions from the proposed Project are not expected to cause a deterioration in the local air quality. It is also concluded that offshore emissions from the Project will not be a significant contributor to global emissions and, as discussed in Section 1.4 (Project Need), the project will help to reduce CO_2 emissions and meet climate policy targets in the long-term.

Onshore

Table 7.22 sets out the key sensitivities and potential impacts for onshore air quality arising from the Project.

7.11.4 Potential Mitigation

Options for mitigation will be informed by further assessments, discussed below; and as the proposed Project design is finalised. However, all onshore construction and decommissioning works will adhere to best practice and industry guidance to reduce the potential impacts to air quality. Furthermore, where possible, the proposed Project will minimise vehicle movement during the construction and decommissioning phases and avoid sensitive ecological receptors.

7.11.5 Proposed Approach to Environmental Assessment

Further work is required to identify and assess impacts to air quality arising from any onshore works. Subsequent assessments will be informed by the formal Scoping Opinion and discussions with relevant stakeholders, including NRW and PCC. The exact scope of these assessments will be developed further once the preferred location of all onshore works is known, as the impacts arising from the proposed location(s) may vary depending on siting.

Air quality assessments will be undertaken in accordance with guidance provided by the IAQM in the document '*Guidance on the Assessment of Dusts from Demolition and Construction 2014'* (IAQM, 2014).

Table 7.22 - Key Sensitivities and Potential Impacts for Onshore Air Quality

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Human Health	Impacts from dust and fine particulate matter may affect human health during the Project phases.	Construction Decommissioning	Yes	Potential increased dust particles created during construction may lead to impacts on human health.
	Human health impacts arising from vehicle emissions.	Construction Operational Decommissioning	Yes	An increase in vehicle movements caused, primarily, during construction, may increase pollutant concentrations. However, until the location of landfall, onshore cable route, and proposed site of the substation, are confirmed it is not possible to assess the significance of the effects.
Ecological Receptors	Impacts from dust and fine particulate matter; and vehicle emissions may impact ecological receptors during the Project phases.	Construction Operational Decommissioning	Yes	Ecological receptors, including features of designated sites that are sensitive to nitrogen or acid deposition, may be impacted by significant increases in dust or emissions. Further assessment will be required once the full extent of the Project is confirmed to understand the level of impact.

7.12 Tourism and Recreation

7.12.1 Study Area

The Study Area relevant to this EIA topic is the main EIA Scoping Area shown in Figure 2.1. This area encompasses the main array site plus a 4 km buffer, a broad potential export cable corridor, and series of potential landfall locations, and also a large onshore area within which onshore infrastructure will be located.

7.12.2 Baseline Data

Key sources of data used to inform this section include:

- MMO Interactive Map (MMO, 2017);
- Lle Geo-Portal and the Wales Marine Planning Portal (Welsh Government, 2017c);
- Information presented in EIA Scoping Reports / ESs for other infrastructure projects in this region (PDZ, META, Greenlink);
- NRW Areas Statements (NRW, 2020);
- Project Erebus EIA Scoping Report (MarineSpace, 2019); and
- Various recreation and tourism websites.

7.12.3 Existing Environment

7.12.3.1 Marine Recreational Users (Offshore and Coastal)

Marine recreational use in and around the main array site is limited due to its distance offshore, with a low level of recreational sailing activity recorded in this area. Recreational use increases closer to shore, with a higher density of sailing vessels and other users, including, but not limited to, jet-skis, recreational (hobby) angling vessels, diving, surfing, kayaking and wind-surfing.

Recreational vessels that use this area are likely to be predominantly local vessels, operating out of the large number of local ports and harbours that exist in the south Pembrokeshire region. These include Neyland Marina, Milford Marina, Tenby, Saundersfoot, Fishguard and Stackpole Quay. Some recreational vessel activity will also be via visiting vessels from home ports further afield, including north Wales, north Devon, Cornwall, and the Republic of Ireland. There are 9 Royal Yachting Association (RYA) clubs, 9 RYA training centres, and also a number of marinas and slipways across the south Pembrokeshire region.

Closer inshore, near potential landfall locations such as Freshwater West, surfing is a particular high-intensity recreational activity, with both local and visiting surfers taking advantage of well-renowned surf breaks and associated onshore facilities.

Diving is a popular activity in the offshore Study Area with regular trips to well-known wreck and reef sites leaving from ports including Milford Haven, Dale, Little Haven and Martin's Haven.

There are a number of charter angling vessels that operate off the south Pembrokeshire coast, with 5 vessels listed[15] as operating out of Milford Haven, and others operating out of a variety of other ports including Saundersfoot and, further afield, Swansea and Penarth.

Freshwater West (potential landfall location) is a large sandy beach that, in addition to surfing (see above), also offers recreational opportunities for swimmers, runners, walkers, horse-riders and, occasionally, kite-surfing. Rock-climbing is also a popular activity in the south Pembrokeshire region, with world-renowned locations close to proposed landfall locations.

[15] https://www.charterboats-uk.co.uk/port

7.12.3.2 Tourism and Terrestrial Recreation

Pembrokeshire is an extremely popular tourist destination that attracts visitors from all of the UK and overseas. The Pembrokeshire Coast National Park is the only fully coastal National Park in the UK and the Pembrokeshire Coastal Path is a world renowned 186 mile path that starts in St Dogmaels in north Pembrokeshire and ends in Amroth, south Pembrokeshire. The Coast Path attracts around 1 million user days annually and represents one of the county's most important economic assets.

Pembrokeshire also contains a large number of beaches and small towns and villages that are key to the local tourist industry. All the proposed landfall locations occur within the National Park Boundary and the Coastal Path also runs through these areas. Across Pembrokeshire, 12 beaches had Blue Flag Award status in 2017, the highest number of any county in the country. 14 beaches were also awarded the prestigious Green Coast Award in 2017.

Cycling is also a popular tourist activity across Pembrokeshire and, in recent years, Ironman Wales has been held at Tenby, attracting over 2,000 competitors and tens of thousands of spectators. The bike course element of this popular triathlon event includes roads on the Angle peninsula, including some around Freshwater West.

7.12.4 Identification of Key Sensitivities and Potential Impacts

Table 7.23 provides a summary of the potential effects arising from the proposed Project on those tourism and recreation receptors identified above. These potential impacts will be defined further once landfall, cable route and the substation location has been confirmed.

Table 7.23 - Key Sensitivities and Potential Impacts for Tourism and Recreation

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Recreational vessel activity (sailing, angling, diving, wildlife trips)	Obstruction / alteration to regular recreational routes via construction activity (including export cable installation). Obstruction to anchorages, marinas, slipways etc. during construction activity (including export cable installation). Displacement of vessels (long term) or temporary) due to Safety Zones during construction phase. Reduced access to preferred angling marks / impacts on target species.	Construction Operational Decommissioning	Yes	The offshore nature of the proposed Project means that scope for impacts on marine vessel users exists and will require assessment within the EIA.
Coastal recreational users	Disruption / reduced access to preferred areas for nearshore recreational users, including surfers, divers, swimmers.	Construction Decommissioning	Yes	Proposed landfall and nearshore cable installation works will create disruption during construction and decommissioning phases. The exact scale and significance will need to be assessed by the EIA.
Coastal tourism	Disruption / reduced access to beaches at proposed landfall locations.	Construction Decommissioning	Yes	Proposed landfall works will create temporary disruption on beach users and will require assessment within the EIA.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
	Disruption / reduced access to Pembrokeshire Coast Path.	Construction Decommissioning	Yes	Proposed landfall works may require temporary disruption / diversion of the Pembrokeshire Coast Path. The exact scale and significance of this will need to be assessed within the EIA.
	Visual impact on tourists of construction works and operational scheme.	Construction Operational Decommissioning	Yes	Temporary visual impacts are expected during construction and decommissioning. During the operational phase, the distance offshore of the planned WTGs (>40 km), means that visual impacts on tourism are not expected. However, in the absence of visualisation data at this stage of the project, this potential impact is scoped in for assessment.
Terrestrial recreational users	Disruption to cyclists, walkers.	Construction Decommissioning	Yes	Construction of the onshore infrastructure (onshore cable, onshore substation) will potentially create impacts on cyclists, walkers in the study area. The exact scale and significance of these impacts will be assessed within the EIA.

7.12.5 Potential Mitigation

Potential mitigation measures that could reduce the significance of impacts on recreation and tourism receptors include, but are not limited to, the following:

- Ensuring that key tourism and recreational organisations (marine and terrestrial) are included in the Project Stakeholder Management Plan and that a series of meetings is scheduled throughout the EIA process to provide updates and to gather further information on potential impacts;
- To ensure as much advance warning as possible is provided, with respect to any construction works that have the potential to create impacts on tourism and recreational receptors;
- To ensure adequate signage and information boards are used to notify locals and tourists of planned works;
- To monitor the suitability of mitigation measures implemented on other projects in this area (for example, Greenlink interconnector; META; and Bombora wave energy project) with respect to reducing impacts on tourism and recreational receptors. Where appropriate, adopt and modify these for use on this proposed Project; and
- As far as possible, seek to schedule works at landfall away from peak tourism periods (summer months).

7.12.6 Proposed Approach to Environmental Assessment

As part of the main Project Stakeholder Management Strategy, all local and regional tourism and recreational organisations will be consulted at an early stage of the EIA process in order to:

- Gather information on existing activities in the proposed study area;
- Identify potential impacts via the proposed Project; and
- Identify appropriate mitigation measures.

Based on feedback from the formal Scoping Opinion and these targeted meetings, a full list of potential impacts will be identified and used as the basis of the assessment. Potential impacts during all project phases will be assessed using a standard EIA methodology, with sensitivity of receptor and magnitude of effect combined to predict impact significance.

7.13 Socioeconomics

7.13.1 Study Area

The proposed study area for assessing potential socio-economic impacts will cover several differing geographic scales:

- Local (Pembrokeshire);
- Regional (South Wales); and
- National (Wales).

7.13.2 Baseline Environment

This socio-economic section is based on a desktop study of publicly available data from the Office for National Statistics, Nomis, and from StatsWales. Reference is also made, where appropriate, to content within the Pembrokeshire Demonstration Zone EIA scoping Report (Wave Hub Ltd, 2018). The similar Project details and location of this planned proposed

Project and the Pembrokeshire Demonstration Zone mean that many of the socio-economic figures presented in the PDZ EIA Scoping Report are relevant for this proposed Project.

7.13.2.1 *Population*

The most recent mid-year report distributed by Office for National Statistics (ONS), June 2019, identified the population of Pembrokeshire as 125,055 people - a 3% increase on the previous 10 years. This is similar to the Welsh population (4% increase), and slightly lower than the UK's population (7% increase). In terms of age, individuals between the ages of 0-15 years and 16-64 years had declined slightly over the same time period (4% and 3% respectively). However, residents over the age of 65 years had shown a significant increase of 29% since 2008, which highlights that Pembrokeshire as a county has an ageing population and a decrease in those who are of economically active age (16-64 years). In Wales, and the UK as a whole, there has been an increase in population across all the age ranges.

7.13.2.2 *Employment*

Latest statistics (mid-2019; ONS, 2019) show that 76% of people aged 16-69 in Pembrokeshire are economically active. This is similar to the Welsh figure of 76.7% and only slightly lower than the UK average of 78.5%. There has been a 2.7% increase in Pembrokeshire's economic activity since 2008, compared to 3.3% increase in Wales and 2% in the UK as whole. Mid-year reporting in 2019 (ONS, 2019), shows the overall employment rate within Pembrokeshire is 72.5%, compared with a figure of 73.1% for Wales, and 75.2% for the wider UK. The largest broad industry sector of Pembrokeshire's employment is 'wholesale, retail, transport, hotels and food' employing 33% of the working population between 16 to 69. This is linked to the county's seasonal tourist trade. This is not dissimilar, albeit slightly higher, than the rest of Wales (26%) and the UK (23%).

7.13.2.3 *Gross Value Added (GVA)*

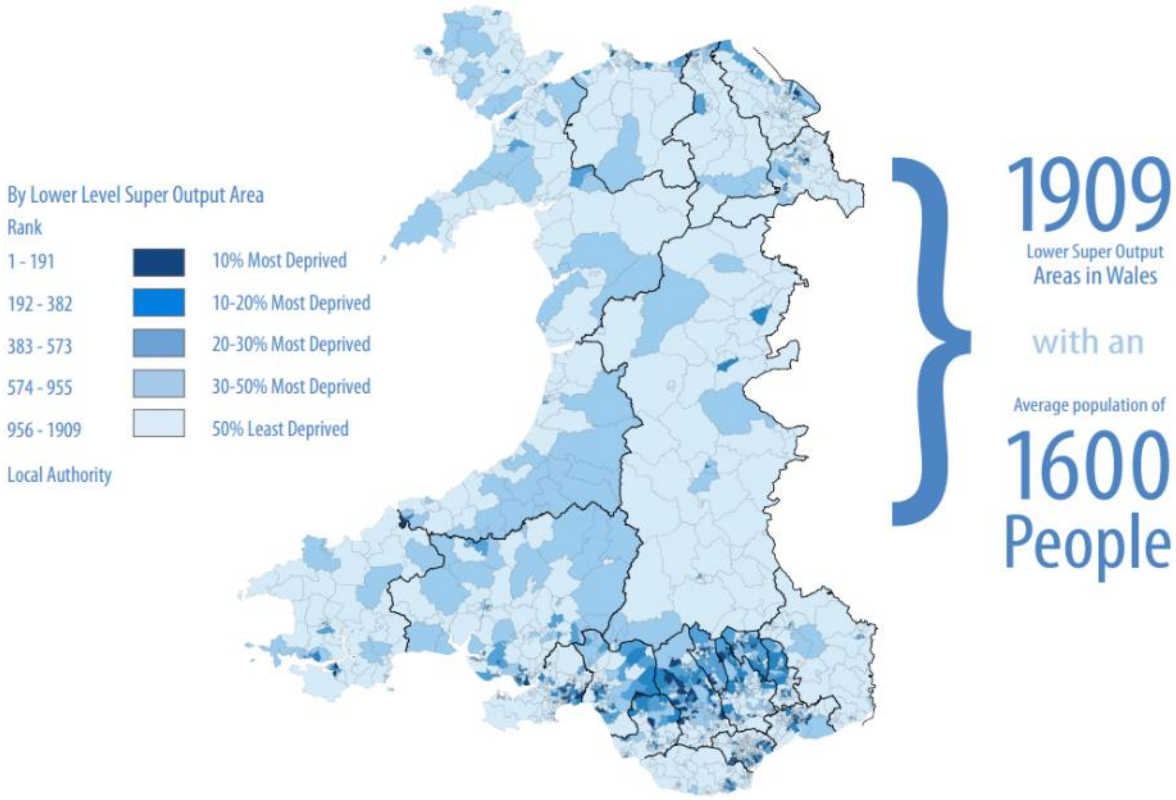
Gross value-added (GVA) is one of the most widely used measures of economic impact. It is defined as the contribution to the economy (value of goods or services) of each individual producer, industry or sector. In 2017 (latest available data), Pembrokeshire GVA was £2,298m, corresponding to £18,427 per head. This was within the context of southwest Wales at £2,305m (£17,610 per head), and the whole of Wales at £62,188m (£19,899 per head).

7.13.2.4 **Welsh Index of Multiple Deprivation (WIMD)**

The Welsh Index of Multiple Deprivation assesses deprivation within small areas of Wales, against the following criteria: income, employment, health education, access to community services, safety, physical environment and housing. The most recent WIMD was published in November 2019

The infographic shows that the majority of Pembrokeshire falls within the 50% least deprived category, with some pockets of the county falling within 30-50% most deprived, a small area within the 20-30% most deprived category, and some areas around the towns of Pembroke Dock and Pembroke within the 10% most deprived category. The areas scored lowest in relation to access to services, education, health and income.

Figure 7.11 - Infographic Showing the Welsh Index of Multiple Deprivation (From: WIMD, 2019)



7.13.3 Identification of Key Sensitivities and Potential Impacts

The proposed Project has the potential to create a wide range of socio-economic impacts to Pembrokeshire and the wider southwest Wales region. An Offshore Renewable Energy Catapult (ORE Catapult) Modelling report, produced in September 2018, identifies the FLOW industry could be worth a net economic benefit of £2bn per year by 2050. The return for this investment is anticipated to be 9,300 direct and 7,700 indirect jobs and £33.6bn of GVA supported by 2050, representing £15 of GVA for each £1 invested in early stage support. It states that economic benefits will accrue from the supply chain winning a large share of the domestic and export market, and from allowing a smooth transition for personnel and organisations from a retreating oil and gas sector.

In addition to the economic benefits stated above, the proposed Project could also contribute to enhancing the following for the region:

- Reduced carbon emissions from electricity production;
- Improvements to existing infrastructure (through leases at ports and contracts with local supply chain);
- Increased knowledge as a result of research and development in floating wind technologies;
- Supply chain development/clustering increasing Wales' ability to service future domestic and international demand;
- Improvements to energy security (depending on the mix of electricity generation displaced);
- Positive social impacts, such as impacts on employment, inequality and earnings.

7.13.4 Potential Mitigation

Mitigation and monitoring measures will be identified early in the proposed Project's lifetime, via engagement with relevant local agencies (e.g. Pembrokeshire County Council, Marine Energy Wales, Marine Energy Engineering Centre of Excellence, ORE Catapult), Pembrokeshire Coast National Park Authority, Port of Milford Haven, Welsh Government) for consideration during on-going environmental assessments and Project development activities. These may entail investigation of measures to maximise supply chain and training opportunities within Pembrokeshire and Wales; and monitoring of Project expenditure, particularly in terms of local employment and business opportunities (e.g. via contracts).

7.13.5 Proposed Approach to Environmental Assessment

A common approach will be used for the assessment of socio-economics; namely:

- Establishing the baseline conditions through a combination of desk review (using existing information as far as possible), and consultations; and will take into account any committed development projects which could change the baseline in the future;
- Identifying potential environmental impacts which could result from development of the proposed Project. These will include potential adverse impacts <u>and</u> potential beneficial impacts;
- Identification of mitigation measures to prevent, reduce and, where possible offset any potential negative impacts which could either by themselves, or in combination with other impacts have a significant adverse effect and agreement of these measures with the Project team; and
- Assessment of the level of significance of all residual effects (direct and indirect, adverse and beneficial, short-term and long-term, permanent and temporary) taking account of committed mitigation measures.

As part of the impact assessment process, an initial impact screening assessment will be undertaken that will assess all potential impacts. Standard EIA methodology (receptor sensitivity x impact magnitude) will be used to determine significance of effects. Only effects identified as potentially significant will then be subject to more detailed assessment within the main Chapter. Table 7.25 summarises the proposed additional data collection to inform the socio-economic assessment.

It is important to note that this chapter of the eventual ES will ensure socio-economic impacts are assessed within the context of EIA Regulations. The chapter will not represent a full report into the potential socio-economic implications of the proposed Project.

Table 7.24 - Key Sensitivities and Potential Impacts for Socio-Economic

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Aging population	The proposed Project could offer attractive options for employment; for those of economically active age to move to the area.	Construction Operational Decommissioning	Yes	The in-migration of economically active population into Pembrokeshire would be considered a positive impact.
Economically active and employment	The proposed Project could create direct and indirect jobs via the Project, in terms of employment and supply chain opportunities, as well as safeguarding jobs in of existing areas of supply chain, ports and marine services.	Construction Operational Decommissioning	Yes	Job security and the creation of new jobs would be considered a positive socio-economic contribution.
Redress industry sectors	Create an increase in Professional roles and reduce the reliance on seasonal roles.	Construction Operational Decommissioning	Yes	Creating more diverse employment opportunities across the county would be considered a positive socio-economic contribution and result in an impact on local business and employment opportunities.
GVA and productivity	Increase productivity for the region, as long as supply chain benefits remain in the local economy.	Construction Operational Decommissioning	Yes	An objective of the Project, and aim for the developer, is to develop the local supply chain to support employment in the county; and although some elements of manufacture may have to be outsourced, where possible all resources will be sourced locally.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Welsh Index of Multiple Deprivation	Increase revenue opportunities within the region, bringing in more cashflow and contributing to more economic benefit. Over time, this may improve opportunities to address health and income aspects around the Pembroke Dock area (where infrastructure and current supply chain employment is based / could increase).	Construction Operational Decommissioning	Yes	As above, it is the intention for the Project to directly contribute to local employment and the local supply chain thus indirectly improving health and income.
Wellbeing of future generations - green branding for locality	Implementation of mitigation measures that strengthen the ‘green’ credentials of the Project / locality will potentially lead to beneficial effects on the wellbeing of future generations for all phases.	Construction Operational Decommissioning	Yes	This is a tangible potential beneficial impact that links to Welsh legislation and should be assessed in detail within the EIA.
Level of commerce activity - green cluster creation	Implementation of measures that increase the understanding of the Project and establish a strong green cluster locally, will potentially lead to beneficial effects.	Construction Operational Decommissioning	Yes	This is a tangible potential beneficial impact that has been noted in other areas (e.g. Orkney) so should be assessed in detail within the EIA.
Training impacts - new skills and competence needs	The proposed Project will offer temporary employment opportunities both in terms of direct construction jobs and opportunities in the supply chain.	Construction Operational Decommissioning	Yes	This is a tangible potential beneficial impact and is very relevant to marine energy aspirations and strategy in Pembrokeshire. Therefore, it should be assessed in detail within the EIA.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Increased supply chain experience and case studies in relation to better marine renewables knowledge	Development of local supply chain will continue to progress and gain for their service portfolio from experience within the Project.	Construction Operational Decommissioning	Yes	As above.
Energy security - more green electricity, local supply, diversity of supply	The Project will help to beneficially support a transition to a more decentralised and decarbonised energy Model by showing how other types of renewable energy may be able to contribute effectively to local, regional and UK energy supply.	Operational	Yes	This is a tangible potential beneficial impact and is very relevant to marine energy aspirations and strategy in Pembrokeshire, Wales and the wider UK. Therefore, it should be assessed in detail within the EIA.

Table 7.25 - Proposed Additional Data Collection to Inform Socio-Economic Assessment

Data Type Required	Capture Method	Analysis Method	Onward Usage
Supply chain capability within Wales and appetite to service the Project.	ORE Catapult, working in partnership with Wales and South West regions (funded by Isles of Scilly LEP and WG) commenced work on a Supply Chain Study in August 2019. The work entitled '*Benefits of Floating Offshore Wind to Wales and the South West*'.	1. Initial desk review of report. 2. Liaise with delivery agents, inputting stakeholders and supply chain, to ascertain relevant suppliers to Project.	Utilise the report to develop good engagement with local suppliers and appropriate tenders (and subsequent contracts), in alignment with Project procurement guidelines. Working with the local supply chain as much as possible will help to maximise such benefits to local enterprises and the local population.
Area economic status	WIMD report Autumn 2019	Download from portal	Ensure maximum opportunities for the region and monitor employment, supply chain etc. engagement benefits, to assess Project impact.

7.14 Human Health

7.14.1 Study Area

The Study Area for this assessment is shown in Figure 2.1 and covers offshore and onshore project areas, including the preferred options for landfall, onshore cable routes and onshore substation locations.

7.14.2 Baseline Data

Baseline data from other sections, including Airborne Noise, Air Quality and Population has been used to inform this section of the scoping report. No specific baseline data has been collected at this stage however feedback from scoping will inform the requirement for further assessments and desk-based reviews. Electromagnetic fields (EMF) emitted during operation (via power cables) is not covered within other chapters but is considered further in this section.

7.14.3 Baseline Environment

There is currently limited information on the human health baseline environment within the proposed study area. A summary of health provision and health issues is provided below.

Within the proposed Study Area, health provisions include 15 GP practices and 29 pharmacies. The County's only general hospital is Withybush Hospital in Haverfordwest; there are 2 community hospitals in Pembroke Dock and Tenby.

Data from the 2011 census shows 22.3% of the population of the County have a long-term illness, which equates to 25,477 people and covers any long-term illness, health problem or disability that limits daily activities or work (ONS, 2001; Welsh Health Survey, 2015).

The primary health issues in the County are considered to be obesity, 63% of the adult population in the County are considered to be obese; and an aging population, Pembrokeshire has a higher % of 65+ year old residents than the rest of the UK (WAG, 2016).

7.14.4 Identification of Key Sensitivities and Potential Impacts

As outlined above, the majority of potential impacts on human health will be addressed via other parts of the EIA process, with the exception being EMF, this is discussed further below.

Impacts arising from traffic and transport are considered in 7.7; airborne noise and vibration in Section 7.10; and air quality in 7.11. Potential impacts include accidents and safety; noise and vibration; impacts from dust and fine particulate matter and vehicle emissions.

EMFs are both naturally produced and a result of human activities, through the natural magnetic field of the Earth and through voltage. The Earth's magnetic field is produced by currents deep inside the core of the planet; the Earth is also subject to electric fields produced by electrical activity in the atmosphere such as thunderstorms. This magnetic field is referred to as a static or "DC" field as it is usually constant and varies in size only slowly over time. Other fields that alternate in their intensity more frequently over time are referred to as alternating or "AC" fields. In the UK, the Earth's magnetic field is approximately 50 μT.

EMFs are also produced via electricity production, distribution and use, including substations, power line and household equipment. Electric fields are produced by a voltage, which is recorded at 230 volts (V) inside UK homes whereas electrical distribution systems in the UK utilise much higher voltages generally from 11,000 to 400,000 volts (11kV to 400kV). Higher voltages relate to a greater electric field, measured in volts per metre (V/m). However, electric fields are eliminated through burying of cables due to the ground and protective sheaths around cables.

The proposed Project will involve maximum voltages of up to 66,000 (66kV). Magnetic fields are measured in microteslas (μT) and are produced by current, which is a measure of the flow of electricity. Generally, the higher the current (measured in amperes or amps) the greater the magnetic field.

No other elements of the proposed Project are anticipated to cause an impact on human health.

7.14.5 Potential Mitigation

Mitigation relevant to impacts arising from traffic and transport; airborne noise and vibration; and air quality are considered further in the relevant sections, set out above.

The electrical infrastructure will be designed to comply with current guidelines on levels of public exposure and design of electrical infrastructure.

7.14.6 Proposed Approach to Environmental Assessment

Assessment of potential impacts on human health via traffic and transport; airborne noise and vibration; and air quality will be assessed via methodologies set out in other sections of this report.

With respect to potential EMF impacts, details of the maximum voltages that will apply to this project will be considered in the context of local populations and relevant industry guidance and standards. Potential impacts will be addressed via the standard EIA matrix set out in Section 3. The definition of key receptors will be defined and agreed with key stakeholders prior to the assessment commencing.

7.15 References

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8 Cumulative Effects Assessment

8.1 Overview

This section of the Scoping Report presents the proposed approach to Cumulative Effects Assessment (CEA) for the proposed Project. CEA is a requirement under the EIA Regulations 2017 (Schedule 4, Paragraph 5(e)).

Even though the proposed Project does not quality as a Nationally Significant Infrastructure Project (NSIP), details set out within PINS Advice Note 17 (version 2, PINS, 2019) have been used as the basis of this assessment.

8.2 Approach

8.2.1 Guidance

The proposed approach to CEA takes account of the following documents:

- PINS guidance (Advice Note 17, Cumulative Effect Assessment version 2, PINS 2019); and
- Cumulative Impact Assessment Guidelines: Guiding Principles for Cumulative Impacts Assessment in Offshore Wind Farms (Renewable UK, 2013).

PINS guidance (Advice Note 17, PINS 2019) identifies that the following types of major developments in the wider study area should be taken into consideration in any CEA:

- Projects under construction;
- Consented / permitted application(s) - but not yet implemented;
- Submitted application(s) - but not yet determined;
- Projects on the National Infrastructure Planning Portal's Programme of Projects;
- Projects identified in the relevant development plan (and emerging development plans – with appropriate weight given as they move closer to adoption) recognising that much information on any relevant proposals will be limited; and
- Projects identified in other plans and programmes (as appropriate) which set the framework for future development consents / approvals, where such development is reasonably likely to come forward.

Other projects built and operational at the time of Scoping for the proposed project have been classified as part of the baseline conditions. Therefore, these projects have been excluded from the CEA and are considered within the baseline for each receptor chapter. For the projects partially constructed, or only recently completed, the full extent of impacts arising from these may not be known, and have therefore been included with the CEA.

Sources of information that will be used to determine projects to include in the CEA will include:

- The Nationally Significant Infrastructure Projects Register;
- The Developments of National Significance Register;
- Planning Policy documents, such as Local Development Plans; and
- Lle Geo-Portal for Welsh for information on marine licensable developments.

8.2.2 Staged Approach

It is proposed that the 4-stage approach outlined in PINS Advice Note 17 is followed for the CEA of the proposed Project, outlined in Table 8.1.

Table 8.1 - Staged Approach to Cumulative Effects Assessment

CEA Stage	Description
Stage 1 - Establish the project's Zone of Influence (ZOI) and identify a long list of '*other development*'	The Project undertakes a desk study to identify the zone of influence (ZOI) for the development, for the topics that are proposed to be scoped into the EIA. The ZOI analysis must be documented (i.e. table of topics and ZOI), with supporting GIS. The long list is drawn up through a desk study of planning applications, development plan documents, relevant development frameworks and any other available sources to identify '*other development*' within the ZOI. Information on each project (county, development type, when occurring, etc.) is documented in a matrix (Matrix 1), along with the certainty or tier assigned to the '*other development*' (i.e. confidence it will take place in the current form and when it will take place in relation to the project). The project then consults with the relevant planning authority(ies) and statutory consultees regarding the long list.
Stage 2 – Identify shortlist of '*other development*' for the CEA	PINS have provided inclusion / exclusion threshold criteria, against which the potential for '*other development*' to give rise to significant cumulative effects by virtue of overlaps in temporal scope, the scale and nature of the '*other developments*' and / or receiving environment, or any other relevant factors is assessed. From this assessment, a shortlist of '*other developments*' to be included in the CEA is produced (Matrix 2). Documented information on each '*other development*' is likely to be high level at this stage, outlining the key issues to take forward.
Stage 3 – Information Gathering	All available information on the '*other developments*' within the shortlist generated at Stage 2 is collated to inform the CEA. This information is ideally included within Matrix 2.
Stage 4 - Assessment	The project reviews each of the '*other development*' in turn to assess whether cumulative effects may arise (documented in Matrix 2). Matrix 2 should also include any mitigation measures where adverse cumulative effects are identified and should clearly signpost to the relevant means of securing mitigation (e.g. DCO requirements and associated mitigation plans). While not to be used as a means to shift the burden of mitigation, it may be appropriate to ascertain the contribution of each development to the effect (done via professional judgement). This may be useful during the consultation with other developers to identify means to jointly address mitigation of significance adverse cumulative effects and means to ensure delivery.

With respect to onshore works specifically, the following extents of search area will be used within the CEA:

- Landfall: Up to 2 km from the landfall areas;
- Onshore export cable corridor: Up to 1 km from the export cable corridor (including within);

- Onshore Substation: Up to 5 km from the substation location.

Once the CEA long list is created (Stage 1 above), all projects and plans will be screened, based on the potential for interaction with the proposed Project. Interaction may be either temporal, spatial or conceptual. The screening of plans or projects will be based upon the potential impacts of each in combination with the proposed Project, therefore, the plan or project may be screened out for one receptor / topic of the ES but screened in for another.

Those plans or projects that are screened in will be carried forward into the CEA. During the screening process it is important to follow the steps above in the defined order as this will allow a clear justification for screening projects in or out. Additionally, this will then allow, projects with low data availability to be screened out, and consideration of those for which there is sufficient data available.

The screening process will follow the criteria in Table 8.2 below:

Table 8.2 - Cumulative Effects Assessment Screening Criteria

Screened Out	Screened In
Project or plan included as part of the baseline; (therefore not considered in CEA); Low data confidence; No conceptual effect-receptor pathway exists; No physical effect-receptor overlap; or No temporal overlap.	Project, plan or activity considered as part of the baseline but has ongoing effects. There is a potential for a cumulative impact to occur.

8.3 Potential Cumulative Impacts

Based on current understanding of the type of effects that may be created by the proposed Project and also the location and status of other projects and plans in the wider study area, the following potential cumulative effects have been identified and will require assessment (Table 8.3 and Table 8.4). It should be noted that due to uncertainty over proposed timelines it is unclear whether there will be temporal overlap between the proposed Project and the projects listed in Table 8.3 and Table 8.4. This will be confirmed by following the CEA process detailed in preceding sections.

Table 8.3 - Cumulative Effects Assessment Offshore Search Area Extents

Project or Plan	Potential Cumulative Impacts
Project Erebus offshore infrastructure (WTG, inter-array cables and export cable)	Underwater noise and vibration Impacts on ornithology and marine mammals, fish and shellfish, designated sites Seascape, landscape and visual impacts Marine seabed and water quality Commercial fisheries and shipping and navigation
Greenlink Interconnector	Underwater noise and vibration Impacts on marine mammals, fish and shellfish, designated sites Marine seabed and water quality Commercial fisheries and shipping and navigation
Bombora Wave Energy Project	Underwater noise and vibration Impacts on ornithology and marine mammals, fish and shellfish, designated sites

Project or Plan	Potential Cumulative Impacts
	Seascape, landscape and visual impacts Marine seabed and water quality Commercial fisheries and shipping and navigation
META	Underwater noise and vibration Impacts on ornithology and marine mammals, fish and shellfish, designated sites Seascape, landscape and visual impacts Marine seabed and water quality Commercial fisheries and shipping and navigation
Pembrokeshire Wave Demonstration Zone	Underwater noise and vibration Impacts on ornithology and marine mammals, fish and shellfish, designated sites Seascape, landscape and visual impacts Marine seabed and water quality Commercial fisheries and shipping and navigation
Castlemartin Firing Range	Underwater noise and vibration

Table 8.4 - Cumulative Effects Assessment Onshore Search Area Extents

Project or Plan	Potential Cumulative Impacts
Project Erebus onshore infrastructure (onshore cables and sub-station)	Terrestrial ecology, ornithology and designated sites Traffic and Transport, Landscape and visual impacts, Land use
Greenlink Interconnector	Terrestrial ecology, ornithology and designated sites Traffic and Transport
Bombora Wave Energy Project	Terrestrial ecology, ornithology and designated sites Traffic and Transport
META	Terrestrial ecology, ornithology and designated sites Traffic and Transport
Pembroke Power Station Emergency Backup Generator	Landscape and visual impacts Designated sites and terrestrial ecology Traffic and transport
Valero CHP Cogeneration Unit	Landscape and visual impacts Designated sites and terrestrial ecology Traffic and transport
Rhoscrowther Wind Farm	Landscape and visual impacts Designated sites and terrestrial ecology Traffic and transport
Blackbridge Energy from Waste Facility	Designated sites and terrestrial ecology
Milford Haven Waterfront Masterplan	Designated sites and terrestrial ecology

Project or Plan	Potential Cumulative Impacts
Solar Farms at Hoplass and Wogaston Farm, Rhoscrowther and Chapel Farm	Land use

8.4 References

PINS (2019). Advice Note 17: Cumulative Effects Assessment Version 2. Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/ [Accessed December 2020]

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9 Summary of Impacts

9.1 Potential Impacts and Scope of EIA

This chapter provide a summary of the potential impacts from the proposed Project identified throughout this Scoping Report. This will form the proposed scope of the EIA, the finding of which will be presented in the subsequent ES.

The potential impacts identified as summaries in Table 9.1

Table 9.1. Summary of Potential Impacts and Scope of EIA

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Physical environment – Physical Processes			
Sediment Transport (Hydrodynamics)	Changes to sediment transport system by changes in wave and current climate.	Construction Operational Decommissioning	Changes in hydrodynamic conditions are possible as a result of construction and / or presence of structures within the scoped area. While local changes are possible, it is not expected that there would be a significant change from baseline regional hydrodynamic conditions and, thus, little effect on baseline sediment transport. This will be assessed and confirmed through the EIA.
Coastal Erosion	Potential changes in sediment transport at the coast.	Construction Operational Decommissioning	Changes to local hydrodynamic regime, for example, changes to tidal energy and wave directions may result in changes to the coastal erosive regime. While this is unlikely, due to the importance of the receptor this will be scoped into the EIA.
Seabed Morphology	There is potential to modify the morphology of the seabed as a result of anchoring structures at the site or resulting from cable lay along the export route.	Construction Operational	Placement of anchoring or cable protection (if required) on the seabed may have the potentially to locally alter hydrodynamics, potentially causing scour and associated alterations to seabed morphology. It is not expected that there will be a significant

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
			change to baseline conditions, however this will be reviewed and confirmed during EIA.
Sediment Transport	Cable lay or anchor placement into mobile seabed, or their removal during decommissioning, or any drilling into hard substrate, if required, may produce additional suspended particles which may become part of the local sediment transport regime.	Construction Decommissioning	Levels of additional sediment generated as part of the construction or decommissioning are expected to be negligible / Low when compared with the baseline local and regional sediment transport, and of a temporary duration, however this will be reviewed and confirmed during EIA.
Physical environment – Marine Sediment and Water Quality			
Water Quality (Suspended Sediment)	Construction and decommissioning activities including drilling of anchors and offshore substation into hard rock seabed, or their removal during decommissioning, cable installation and HDD may produce additional suspended particles which may become part of the local sediment transport regime.	Construction Decommissioning	Increased suspended sediments leading to smothering of surrounding habitats or a release of contaminated sediments is very unlikely in a strongly tidal area. If an increase in suspended sediments does occur, this will be rapidly dispersed due to tidal flows. The tidal flows will also reduce any smothering potential due to increased dilution and dispersion rates.
Water Quality (Suspended Sediment)	Changes to sediment transport system caused by changes in wave and current climate.	Construction Operational Decommissioning	Increased suspended sediments leading to smothering of surrounding habitats, or a release of contaminated sediments as a result of changes in hydrodynamics, is very unlikely in a strongly tidal area. If an increase in suspended sediments does occur, this will be rapidly dispersed due to tidal flows. The tidal

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
			flows will also reduce any smothering potential due to increased dilution and dispersion rates.
Water Quality (Chemical Contamination)	There is the potential for accidental release of fluids into the environment through construction, operational and decommissioning phases.	Construction Operational Decommissioning	The risk of this is managed through the implementation of industry standard best practice guidelines, for example, appropriate use of chemicals, spill response, marine pollution contingency plans and guidance for pollution prevention (GPPs); therefore, the risk of pollution is not deemed to be significant.
Sediment Quality (Contamination of Marine Sediments)	There is the potential for accidental release of fluids into the environment through construction, operational and decommissioning phases.	Construction Operational Decommissioning	Industry standard best practice guidelines will be followed at all times, for example, appropriate use of chemicals, E response, marine pollution contingency plans and GPP, (in particular GPP1 and GPP5); therefore, risk of contamination is not deemed to be significant.
Bacteria	The introduction of transmission cables into the marine environment may influence growth of temperature responsive bacteria.	Operation	Any temperature increases from transmission assets are expected to be very small and highly localised. It is anticipated that the potential influences on bacterial growth rate will be negligible.
Bathing Waters and Shellfish Water - Bathing Waters: Freshwater West - Bathing Waters: West Angle	There is potential for any of the impact pathways identified above to result in adverse effects on water quality of designated bathing waters.	Construction Operational Decommissioning	The risk of changes in water quality of a magnitude sufficient to impact classification of designated water bodies is considered very low. Any changes in water quality are likely to be highly localised, and it is expected that strong tidal flows in the region will prevent any change from being detectable at designated bathing water sites.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Physical environment – Intertidal, Onshore Geology and Geomorphology			
Geological Features Regionally Important Geological Sites: East Pickard Bay Sawdern Point West Angle Bay Caled Quarry Bosherston Longstone Down Bullslaughter Bay New Quay Middle Cove Stackpole Head Angle Bay Geological Conservation Review Sites: Blucks Pool - Bullslaughter Bay Freshwater East Freshwater West South Pembroke Stackpole Quay Tenby Cliffs West Angle Bay	Damage or disturbance of geological features of interest through installation / removal of infrastructure and associated construction activities.	Construction Decommissioning	As the exact cable route is currently unknown, there is potential for disturbance of geological features of interest and is therefore scoped in for assessment. It is not anticipated, however, that there will be an impact on geological features from the onshore works. With the exception of the landfall, no significant excavation into the underlying geology would be expected, with any excavations being within surface soils. Landfall installation would either require open trenching or HDD drilling through rock.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Geomorphology / Soils	Damage or removal of geomorphological (topographical) and / or soil features.	Construction Decommissioning	Excavation of the onshore cable route and groundworks for the substation are expected to be predominantly within areas that are already modified. As cable will be buried, it is not anticipated that there would be permanent changes to geomorphology or topography, although there may be temporary disturbance during construction and possibly decommissioning phases. Once buried, the ground level of the cable route would be returned to near baseline conditions. It is not anticipated that there would be an impact on geomorphology or topography. However, the exact cable route is currently unknown and there may be localised impacts requiring further assessment.
Soil	Compaction and degradation of soils.	Construction Decommissioning	Excavation works during installation of the onshore cable route are likely to disturb surface soils. This can result in compaction and degradation of excavated soils, particularly topsoil. The extent of significance would be influenced by the final locations and construction methodology used. In addition, construction plant activities may also cause compaction of soils in the surrounding working area. Installation in areas of made ground are less likely to result in impacts to surface soils.
Physical environment – Onshore Groundwater and Hydrology			
Hydrology	Changes to hydrology (including private water supplies).	Construction Operational Decommissioning	The cable route may need to cross hydrological features such as streams or drainage channels. The impacts of this will be dependent on construction methodology, location and nature of hydrological features in the development area.
Surface Water Bodies	Sediment suspended as a result of construction or decommissioning activities may enter surface water bodies.	Construction Decommissioning	Increased sediment supply could result in localised increases in turbidity and alter sediment deposition patterns and locations downstream of the source point.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Surface Water Bodies and Groundwater	Release of contaminants to surface waters and groundwater.	Construction Decommissioning	Onshore activities associated with construction and decommissioning works have the potential for accidental release of contaminants which could directly enter surface water bodies or enter the groundwater.
Flood Risk	Alteration to flood risk as a result of onshore works.	Construction Operational Decommissioning	The onshore works may be located within areas at risk from river, tidal or coastal flooding. The impacts of this will be dependent on construction methodology, location and nature of hydrological features and flood risk zones in the area of works, which is currently unknown. Flood risk (including sea level rise associated with climate change) should therefore be considered further as part of the EIA.
Physical environment – Water Framework Directive			
WFD Designated Water Bodies	There is the potential that sediments could be suspended into the water column during construction and decommissioning (installation of cables and during landfall activities).	Construction Decommissioning	Increased suspended sediments, sufficient to lead to deterioration in status is very unlikely in the tidal coastal area. If an increase in suspended sediments does occur, this will be temporary in nature and will be rapidly dispersed due to tidal flows. Increased sediment supply as a result of onshore activities could potentially result in localised increases in turbidity in river, lake, and groundwater water bodies.
WFD Designated Water Bodies	There is the potential that contaminated sediments could be suspended into the water column during construction and decommissioning, and contaminants adsorbed onto particles could be released to designated water bodies.	Construction Decommissioning	Activities associated with construction and decommissioning works are associated with potential for accidental mobilisation of contaminants in the sediment which could directly enter surface water bodies or enter groundwater.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
WFD Designated Water Bodies	Accidental release of contaminants from vessels and plant.	Construction Decommissioning	Activities associated with construction and decommissioning works have the potential for accidental release of contaminants which could directly enter surface water bodies or enter the groundwater.
WFD Designated Water Bodies	Installation of permanent project infrastructure (cable protection) within boundary of WFD water body.	Operational	The potential impacts caused by rock armour protection are essentially permanent impacts and if they are located in a WFD water body, they will directly impact on the waterbody hydromorphology and biological elements and have the potential to affect waterbody status.
Migratory fish	There is potential for electromagnetic fields (EMF) and thermal effects from transmission assets to have influence the behaviour of migratory fish travelling to/from WFD rivers and transitional water bodies.	Operational	EMF emissions and thermal increase may arise in the immediate area around Project transmission assets. However, where they occur these changes are only discernible within the immediate vicinity of the transmission infrastructure. The extent affected will constitute a very small proportion of the total habitat available, therefore it is unlikely that this will result in a significant effect.
Biological environment – Terrestrial Designated Sites			
Special Areas of Conservation Pembrokeshire Bat Sites and Bosherston Lakes Limestone Coast South West Wales	Installation / removal of infrastructure, associated construction activities and operation of the substation has the potential to cause disturbance through noise, vibration and lighting, severance and loss of foraging habitat and commuting corridors.	Construction Operational Decommissioning	Dependent on final onshore infrastructure locations/ layouts; Potential damage and loss of habitats; Reduction in foraging success; Behavioral changes and injury to individuals and potential stress to protected species (bats).

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Special Protection Areas Castlemartin Coast	Installation, maintenance and removal of infrastructure and construction has the potential to disturb breeding habitat and result in the loss of foraging habitats.	Construction Operation Decommissioning	Reduction in foraging success; Behavioral changes and injury to individuals and potential stress to protected species (birds).
Sites of Specific Scientific Interest Angle Peninsula Coast Broomhill Burrows Castlemartin Corse Castlemartin Cliffs and Dunes Castlemartin Range Freshwater East Cliffs to Skrinkle Haven Gweunydd Somerton Meadows Orielton Stable	Installation / removal of infrastructure, associated construction activities and operation of the substation has the potential to cause direct habitat loss and disturbance through noise, vibration and lighting, severance and loss of foraging habitat, and commuting corridors.	Construction Operational Decommissioning	Potential damage and loss of habitats; Reduction in foraging success (bats, fish and birds); Behavioral changes and injury to individuals and potential stress to protected species (bats, fish, birds, otters).

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Block and Cellars Stackpole Stackpole Quay to Trewent Point Stackpole Courtyard Flats and Walled Garden Park House Outbuildings, Stackpole			
National Nature Reserves Stackpole	Installation / removal of infrastructure and associated construction activities have the potential to cause disturbance to species and habitats, loss of habitat and severance of connectivity.	Construction Decommissioning	Potential damage and loss of habitats; Reduction in foraging success; Behavioral changes and injury to individuals and potential stress to protected species (bats).
Local Nature Reserves Freshwater East	Installation / removal of infrastructure and associated construction activities has the potential to cause noise disturbance and loss of habitat.	Construction Decommissioning	Potential damage and loss of habitats.
Biological environment – Marine Designated Sites			

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Special Protection Areas Skomer, Skokholm and the Seas off Pembrokeshire Full list of SPAs provided in Appendix B	Installation, operation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect). Potential disturbance and risk of pollution incidences impacting habitats and species near export cable landfall.	Construction Operational Decommissioning	Potential damage and loss of habitats and features; Potential mortality of key species due to collision risk; Create alteration in migratory routes; Reduction in foraging success; Behavioural changes and injury to individuals and potential stress to protected species (birds).
Special Areas of Conservation West Wales Marine Pembrokeshire Marine Bristol Channel Approaches Limestone Coast of South West Wales North Anglesey Marine	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance (including UXO clearance) and loss of habitat leading to reduced prey availability. Potential disturbance and risk of pollution incidences impacting habitats and species near export cable landfall. Mooring lines and cabling between the platform and the anchors used during the	Construction Operational Decommissioning	Potential damage and loss of habitats and features. Create alteration in migratory routes; Reduction in foraging success (bats, fish and birds); Behavioural changes and injury to individuals and potential stress to protected species (bats, fish, birds, otters and marine mammals (grey seals and harbour porpoise)). There is a risk that marine mammals using the area may get tangled in mooring lines. The mooring lines may also become entangled with derelict fishing gear, which may further increase the chance of entanglement, though the likelihood of this is poorly understood.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Pen Llyn a`r Sarnau	project could pose an entanglement risk to marine mammals.		
Sites of Specific Scientific Interest Arfordir Penrhyn Angle / Angle Peninsula Coast Castlemartin Range Skokholm Stackpole Dale and South Marloes Coast De Porth Sain Ffraid / St Bride's Bay South Milford Haven Waterway	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect). Potential disturbance and risk of pollution incidences impacting habitats and species near export cable landfall.	Construction Operational Decommissioning	Potential damage and loss of habitats and features; Reduction in recruitment and spawning success; Create alteration in migratory routes; Reduction in foraging success (fish and birds); Behavioural changes and injury to individuals and potential stress to protected species (fish, birds, otters and marine mammals (grey seals)).
National Nature Reserves Skokholm Stackpole	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect).	Construction Operational Decommissioning	Potential damage and loss of habitats; Create alteration in migratory routes; Reduction in foraging success (fish and birds); Potential collision risk; Behavioural changes and injury to individuals and potential stress to protected species (birds and marine mammals (grey seals)).

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
	Potential disturbance to habitats and species near export cable landfall.		
Heritage Coast South Pembrokeshire Marloes and Dale	Installation and removal of infrastructure directly impacting features	Construction Operational Decommissioning	Potential damage and loss of features.
Ramsars Burry Inlet Les Pierres de Lecq (the Paternosters) Jersey Les Écréhous & Les Dirouilles, Jersey Baie du Mont Saint-Michel South East Coast of Jersey, Channel Islands Les Minquiers, Jersey Baie de Seine	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance (including UXO clearance) and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect).	Construction Decommissioning	Reduction in foraging success; Behavioural changes and injury to individuals and potential stress to protected marine mammal and bird species.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
orientale Baie de Somme			
Biological environment – Benthic Ecology			
Offshore Array - Turbines: installation, maintenance and removal of turbine infrastructure (e.g. anchor mooring) **Protected Subtidal** habitats and associated species (as listed in Table 6.8)	Physical disturbance to protected habitats and species and habitat loss / displacement. The sensitivity of the habitats will depend on the species present, as determined during surveys. Extent of effect will be limited to the Project infrastructure footprint. Habitat loss may be temporary, such as through vessel anchoring, or long term (considered between 15 and 60 years, i.e. for the duration of the Project) if it is due to footprint of infrastructure installation.	Construction Operational Decommissioning	No piling or drilling to install the turbine infrastructure within the Offshore Array is anticipated at this stage, however, anchor moorings will be an important consideration. The preferred option for the WTGs is the use of catenary moorings with drag anchors. Suction piles and drilled piles will be considered depending on the site-specific ground conditions. Habitat is likely to contain mostly robust fauna that has limited sensitivity, and a wide area of A5.27 is available surrounding the Offshore Array. There are no known Annex I habitats within footprint of the array. However, as the species present are not known, this impact will be taken forward to the EIA.
Inter-Array and Marine Export Cables (ECR) and Landfall: installation, maintenance and removal of infrastructure (cable laying (and protection),		Construction Operational Decommissioning	Horizontal directional drilling (HDD) may be required at the landfall location. It may be necessary for temporary cofferdam installation at the planned HDD exit point. The inshore subtidal and intertidal areas have known Annex I habitats and features that are designated as part of the Pembrokeshire Marine SAC, such as sea caves, subtidal sandbanks, mudflats and sandflats, and reefs. These may be highly localised and support significant biodiversity.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Installation of cable landfall) **Protected Subtidal/Intertidal** and associated species (as listed in Table 6.8)			This impact will be assessed under the EIA. Mitigation measures can be undertaken to reduce these impacts.
Offshore Array - Substation: Installation, maintenance and removal of infrastructure **Protected Subtidal Habitats** and associated species (as listed in Table 6.8)		Construction Decommissioning	Piling and / or drilling is anticipated for installation of the offshore substation if fixed installation is decided. Should a floating offshore substation be taken forward, this would be installed and attached to the seabed through drag anchors. However suction piles and drilled piles may be considered depending on ground conditions. Habitat is likely to contain mostly robust fauna that has limited sensitivity, and a wide area of A5.27 is available surrounding the Offshore Substation. There are no known Annex I habitats within footprint of the Offshore Substation. However, as the species present are not known, this impact will be taken forward to the EIA.
Inter-Array and Marine Export Cables (ECR): Installation/laying of cable and cable protection. **All Subtidal Habitats** and	May cause increased suspended sediment concentration and sediment deposition. May affect benthic habitats through smothering or decreases in water quality.	Construction Decommissioning	The amount of resuspended sediment is expected to be minimal, as is the footprint of any such sediment plume that will be detectable above background conditions (though this will depend on hydrodynamic conditions at the time). The majority of the project footprint is in an area of coarse sediment (i.e. sand) or rock, further reducing the likelihood for notable sediment resuspension, though there are areas of fine / muddy sand in the nearshore.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
associated species along route.			The species present (aside from Annex I habitats) are not well known, therefore it is not possible to determine their sensitivity to this effect, and as such it is scoped into the EIA.
	Dynamic submarine power cables connecting the platform to the seabed may result in electromagnetic fields (EMF) emissions generated by current flow passing through the cables. Although armored, these will not be buried in the seabed. May cause changes in predator/prey interactions, behaviour, and physiological and developmental effects on benthic invertebrates (e.g. decapods, cephalopods or cnidarians)	Operational	The potential impacts from dynamic submarine power cables on benthic receptors may not be of significance overall where studies have reported minor or non-significant effects from EMF emissions. However, as there is an uncertainty regarding this potential impact on benthic species, as such it is scoped into the EIA.
General Project Activities (including vessel movements) **All Habitats** and associated species in Study Area.	Pollution of water and sediment through accidental release of pollutants or chemicals from vessels. May affect subtidal benthic and intertidal ecology throughout the study area accessed by vessels.	Construction Operational Decommissioning	Accidental release has the potential to negatively impact benthic communities. Although the likelihood of this impact is extremely low given the industry standard mitigation measures that are expected to be put in place (see Section 6.2.5), as there is the potential for an impact, as such it is scoped into the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
	Potential introduction and spread of Invasive Non-native Species (INNS via vessel hull or ballast water, and the introduction of new structures to provide suitable substrate for such species. Can cause displacement of local fauna, species and habitat loss.	Construction Operational Decommissioning	Vessels used during the project may inadvertently transport INNS. This can have significant impacts on local fauna through displacement, and the effects may not be restricted to the immediate area as any INNS could spread rapidly. It is possible that infrastructure will be brought into and out of the nearby Pembroke Dock, and the introduction of the structures themselves may allow a localised spread of any already established INNS populations in the region. As such, impacts from priority marine species will be assessed in the EIA.
	Project infrastructure can cause changes in hydrodynamic regime, which can in turn impact the benthic ecology through inter-related effects.	**Scoped Out**	There is expected to be minimal subsea infrastructure due to the semi-submersible nature of the Project. Subject to final design of the offshore substation, there is likely to be one jacket structure for the offshore substation. The changes to hydrodynamics are anticipated to be negligible, therefore it has been scoped out of the EIA.
	Introduction of new habitat in the form of project infrastructure, including cable protection, may affect the established environment by providing new habitat / ecosystem function.	Operational	This could be a potential benefit to the environment as it may increase presence of species that are known to use hard structures for protection or species that attach to similar hard substructures.
Biological environment – Fish and Shellfish Ecology			
Demersal fish (spawning and nursery areas)	Habitat Loss / Disturbance Activities that have the potential to cause habitat loss and / or disturbance to spawning and	Construction Operational Decommissioning	Species that lay their eggs on specific seabed types, such as herring, or species that live in specific sediments, such as sand eel, may be affected by activities that have the potential to disturb, alter or remove seabed sediments e.g. cable trenching.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
	nursery areas, including installation of moorings; marine export cable installation; cable protection.		The significance of the impact would be dependent on methods, project design and location.
Demersal fish and shellfish	Increases in sediment or water temperature as a result of subsea cable operation.	**Scoped Out**	The exact amount of heating depends on cable specification and surrounding sediment characteristics; however, heat will dissipate quickly, and any heating will only be marginally above baseline conditions. Based on monitoring data collected from numerous operational UK OWF projects, no impacts are expected to demersal fish species and shellfish in close contact with the seabed via increased water temperatures.
All Fish Species	Fish Aggregating Device effect of floating platforms.	Operational	There is the potential for floating platforms, anchoring devices, and offshore substation (potential jacket structure) to act as a fish aggregating device.
All fish species (including migratory species)	Underwater Noise Impacts on fish species from underwater noise including UXO clearance.	Construction Operational Decommissioning	Underwater noise from the installation of the offshore substation (piling) and WTG anchors has the potential to displace migratory fish from their migration routes if this passes through the offshore scoping area during construction. During the operational period, noise levels are expected to be significantly lower than those during construction. The sensitivity of fish to underwater noise is not well documented and pathways of migratory fish are not well understood once individuals leave rivers
Fish and shellfish adults and larvae	Increased turbulence in the area due to increased particle motion and vibration.	**Scoped Out**	There is the potential for an increase in localised water turbulence as a result of vibrational forces originating from the turbine and floating platform structure. However, the impact of vibrational forces produced by offshore windfarms is unlikely to cause significant changes in local fish populations, with any disturbance caused by this increase in

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
			local turbulence being outweighed by the FAD effects of the floating platform (Langhamer et al., 2017). High intensity sounds (>200dB) have the capability to injure or kill fish eggs and larvae several metres from the sound source. However, it is highly unlikely that vibrational effects of wind farms would be capable of producing forces of this intensity (Vella et al., 2001).
Shellfish	Loss of shellfish habitat	Construction Operational	Loss of habitat through placement of devices and swept area of mooring cables has the potential to remove habitat for shellfish. The significance of this would be dependent on the final project design and the importance of the area for shellfish.
Fish and shellfish (including migratory fish)	Increased Suspended Sediment Concentrations Impacts on fish and shellfish through a decrease in water quality.	Construction Decommissioning	Construction methods that create sediment plumes also have the potential to release contaminants (if present) into the water column. This could result in decreased water quality that could impact on the health of fish and shellfish populations and potentially impact on the quality of commercial species. The significance of the impact will depend on the construction methodology, the presence of contaminants and the abundance of species in the offshore scoping area.
Fish and shellfish	Loss of Habitat Reduced resource availability	Construction Operational Decommissioning	The loss or alteration of habitats within the development have the potential to impact on resource availability and prey distribution within the offshore scoping area. The significance of the impact will be influenced by the extent of any change to benthic habitats and the importance of those areas as a resource.
Fish and Shellfish	There is potential for electromagnetic fields (EMF) and thermal effects from transmission assets to have influence on the behaviour of	Operational	EMF emissions and thermal increase may arise in the immediate area around Project transmission assets. However, where they occur these changes are only discernible within the immediate vicinity of the transmission infrastructure. The extent affected will constitute a very small proportion of the total habitat

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
	fish and shellfish in the local area.		available, therefore it is unlikely that this will result in a significant effect.
Migratory fish	EMF as a barrier to migratory fish	Operational	Potential EMF effects on fish species has been investigated and there is no clear evidence of any adverse impacts as demonstrated in previously assessed and consented offshore wind farms (OWF). Post-construction monitoring of fish in operational OWF projects around the UK has shown no absence of electro-sensitive species (rays; dogfish) in these areas, indicating that installed subsea cables have no impact on these species. However, given there is uncertainty, EMF impacts will be considered within the ES.
All fish species (including migratory species)	Ghost fishing from lost fishing gear, entangled in the mooring system could pose an entanglement risk to fish.	Operational	There is a risk that fish using the area may become entangled with derelict fishing gear, though the likelihood of this is poorly understood. For previous FLOW projects in Scottish waters, Marine Science Scotland stated that they consider that the effects of “ghost fishing”, whereby derelict fishing gear becomes entangled on the mooring lines and has the potential to then entangle fish, as very difficult to quantify at this stage.
Biological environment – Marine Mammals and Reptiles			
All marine mammals	Operations associated with the Project, such as vessel movements and installation of moorings and offshore substation, will produce underwater noise, which has the potential to affect marine mammal species (*note that*	Construction Operational Decommissioning	Marine mammals are sensitive to underwater noise. They use underwater noise for prey detection, predator avoidance, communication, navigation etc. Increases in underwater noise can lead to physical and auditory injury, behavioral changes or masking. The amount of noise from the Project is expected to be limited in comparison to other offshore wind projects. Piling/drilling is anticipated for the construction of the offshore substation, and so will be temporally limited (see Section 4 (Project Description) and Section 7.9 (Underwater Noise and Vibration)). Other potential anchor solutions for WTG, such as

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
	UXO detonation is assessed separately below).		suction and drilled piles, may also be utilized (depending on ground conditions), although not the preferred option. It is anticipated that there is potential for injury thresholds to be exceeded by this pathway, though this will be investigated through noise modelling as part of the EIA if required. Noise from other project sources are not expected to exceed injury levels, though disturbance by vessel noise, trenching, or cable and cable protection laying is possible. An assessment of the noise impact from the Project alone and in-combination will be undertaken in the EIA.
Marine reptiles	Operations associated with the Project, such as vessel movements and installation of moorings will produce underwater noise, which has the potential to affect marine reptiles.	Construction Operational Decommissioning	Little is known about the sensitivity of marine turtles to underwater noise, however recent research indicates that they are sensitive to low frequencies (peak hearing for leatherback turtles is 100-400 kHz; Piniak *et al.,* 2012) such as those produced during project operations. This impact is therefore scoped in for further assessment.
All marine mammals and reptiles	There is potential for UXOs to be present in the area; if this is the case, their controlled detonation can cause injury to marine mammals and reptiles	Construction	The area is close to the Castlemartin firing range and so may contain UXOs. Controlled UXO detonation, if required, can cause lethal and sub-lethal injuries to marine mammals and reptiles, with the severity of injury decreasing with distance from the explosion. Though it is not certain that UXOs will be discovered, the impact has been scoped in due to its potential severity.
All marine mammals and reptiles	Increased collision risk from the vessels to be used during the Project, which may cause harm to marine mammal and reptile species.	Construction Operational Decommissioning	Both marine mammals and turtles have been known to be impacted by ship strikes, large cetaceans in particular. The likelihood of injury depends on the vessel speed. An assessment of the collision risk from the Project alone and in-combination with other projects and existing vessel traffic will be undertaken in the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
All marine mammals and reptiles	Accidental and unplanned release of chemicals and pollutants from vessels used during the Project has the potential to cause harm to marine mammals and turtles.	**Scoped Out**	The risk of accidental and unplanned release of chemicals and pollutants from vessels is considered extremely low. An Environmental Management Plan (EMP) will be created, with procedures that will minimise the risk of such events and contain measures to minimise the impacts should they occur. This interaction is scoped out of the EIA.
All marine mammals and reptiles	Operations associated with the Project may cause sediment resuspension and so changes in water quality, which may impact the visual behaviour of marine mammals and reptiles.	**Scoped Out**	The marine mammal species common to the project site inhabit coastal waters that are often turbid, and so they will have a natural level of adaptation to increased sediment suspension. In addition, there is minimal suspended sediment expected to be generated due to the semi-submersible nature of the project, and the great water depth will restrict the effects to a small fraction of the water column near the seabed.
All marine mammals and reptiles	Infrastructure associated with the Project may cause barrier effects from the mooring lines, which could disrupt the passage of marine mammals and turtles.	Operational	The configuration of the WTGs and moorings is currently unknown. This interaction has been scoped in as a precautionary measure however it is not expected to be significant and is likely to be scoped out upon further assessment.
All marine mammals and reptiles	Mooring lines and cabling between the platform and the anchors used during the project could pose an entanglement risk to marine mammals and reptiles.	Operational	There is a risk that cetaceans, pinnipeds and turtles using the area may get tangled in mooring lines. Large cetaceans (such as minke whale) are considered at greatest risk to this impact (SNH, 2014). The mooring lines may also become entangled with derelict fishing gear, which may further increase the chance of marine mammal entanglement (SNH, 2014), though the likelihood of this is poorly understood. For previous FLOW projects in Scottish waters, Marine Science Scotland (MSS) agreed that the risk of entanglement for marine mammals in any vertical mooring lines was very small, as was similar risk from catenary lines. MSS also stated that they consider that the effects of “ghost fishing”, whereby derelict

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
			fishing gear becomes entangled on the mooring lines and has the potential to then entangle marine mammals, as very difficult to quantify at this stage.
Pinnipeds	The presence of vessels close to the coast could lead to the disturbance of coastal and onshore habitats used by seals e.g. haul-out sites, breeding and foraging areas.	Construction Operational Decommissioning	Seals that are present at their coastal sites for breeding, moulting, and nearshore foraging, could be affected by vessels in this way. The level of disturbance is correlated with the distance from the vessel; at <900 m seals can exhibit a fleeing response, at 900-1,500 m the vessels is detectable, and at 1,500 m the vessel is not detectable. This impact will be further considered in the EIA.
All marine mammals and reptiles	Subsea cables for the Project may result in electromagnetic fields (EMF), which can impact the navigation of marine mammal and turtle species.	**Scoped Out**	Many marine mammal and turtle species make long-distance migrations and are thought to use the Earth's magnetic fields for navigation. There is no evidence of subsea cables associated with OWF project affecting these migrations, even with >25 operational UK OWF projects. Therefore, this impact is proposed to be scoped out of the EIA.
All marine mammals and reptiles	The Project operations have the potential to cause indirect effects to marine mammal and turtle species through impacts to their prey.	Construction Operational Decommissioning	All marine mammal and turtle species could be affected by changes to their prey as a result of the Project. An assessment of this will be undertaken in the EIA, taking into account the assessment of impacts to key prey species in the benthic ecology and fish and shellfish ecology chapters. This may include impacts that have been scoped out as a direct risk to marine mammals and reptiles, such as sedimentation.
Biological environment – Ornithology			
All seabirds (divers, grebes, cormorant/shag, seaducks, tubenoses, gannet,	Direct loss of seabed habitat used by foraging birds due to placement of project infrastructure.	Construction Operational Decommissioning	Placement of offshore project infrastructure may result in the loss of benthic habitat within the project footprint. This is likely to be limited to the locations of the electrical infrastructure and drag embedment anchor locations. The area of habitat disturbed by the anchors is likely to be very small and the resulting loss of prey resource is likely to be

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
gulls, terns, and auks)			negligible. Where seabed conditions are not suitable for drag embedment anchors, pile driven or suction piles may be used as an alternative. The offshore bird surveys will provide data on the importance of these areas to foraging birds.
Diving birds (divers, grebes, cormorant/shag, seaducks, gannet, terns, and auks)	Disturbance (displacement) to birds due to noise from construction and decommissioning activities, including general vessel movements, piling and unexploded ordnance.	Construction Decommissioning	Data from construction and operational phases of OWF projects around the UK coast indicate that displacement of certain bird species can occur due vessel movements and piling operations during construction and decommissioning works.
Diving birds (divers, grebes, cormorant/shag, seaducks, gannet, terns, and auks)	Increased risk of auditory damage to diving seabird species from high intensity underwater noises such as piling and unexploded ordnance.	Construction Decommissioning	Underwater noise emissions, such as those from piling activities (installation of the offshore substation) and unexploded ordnance detonation, can result in disturbance and displacement effects, and may result in physiological damage if birds are near to the source of noise.
Diving birds (divers, grebes, cormorant/shag, seaducks, gannet, terns, and auks)	Reduction in foraging success of diving bird species due to increased noise emissions, such as piling and unexploded ordnance.	Construction Decommissioning	Underwater noise emissions can interfere with seabird predation success. Increased noise in the environment can result in disturbance and displacement, which can result in exclusion of seabirds from foraging areas. Additionally, underwater noises can affect prey species, reducing the availability of them to seabirds.
All seabirds (divers, grebes, cormorant/shag, seaducks, tubenoses, gannet, gulls, terns, and auks) and migratory	Increased risk of mortality due to collision with WTGs.	Operational	Birds in flight are at risk of collision from WTGs. Key sensitivities include migrating birds and birds in transit between breeding sites and foraging areas. The offshore bird surveys will determine which species are present and the spatial and temporal distribution of flight activity through the wind farm area.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
birds (incl. waders and wildfowl)			
All seabirds (divers, grebes, cormorant/shag, seaducks, tubenoses, gannet, gulls, terns, and auks) and migratory birds (incl. waders and wildfowl)	Barrier effect of WTGs to regular movements of birds to and from breeding colonies or on migration.	Operational	The introduction of WTGs may result in a barrier effect to birds. Those species that make regular movements through the wind farm area between breeding sites and foraging sites or birds on migration are most sensitive. The offshore bird surveys will determine which species are present and the spatial and temporal distribution of flight activity through the wind farm area.
All seabirds (divers, grebes, cormorant/shag, seaducks, tubenoses, gannet, gulls, terns, and auks)	Displacement of birds from foraging or loafing areas due to effective loss of habitat if birds avoid the wind farm and its surrounds due to the physical presence of project infrastructure and maintenance activities.	Operational	The presence of offshore WTGs and associated project infrastructure and maintenance activities has the potential to result in displacement of birds from the wind farm and surrounding area. The offshore bird surveys will provide information to inform which species are present in the area and the spatial and temporal distribution of species using the site.
Diving birds (divers, grebes, cormorant/shag, seaducks, gannet, terns, and auks)	Disturbance to foraging diving birds from underwater noise and vibration from operational floating WTGs.	Operational	Underwater noise and vibration from the operating WTGs may disrupt or interfere with the ability of diving birds to forage successfully. The offshore bird surveys will provide information to inform which diving species are present in the area.
Diving birds (divers, grebes, cormorant/shag, seaducks, gannet, terns, and auks)	Ghost fishing from lost fishing gear caught around mooring lines and cables could pose an entanglement risk to diving seabirds.	Operational	There is a risk that diving seabirds may become entangled with derelict fishing gear, though the likelihood of this is poorly understood. For previous FLOW projects in Scottish waters, Marine Science Scotland stated that they consider that the effects of “ghost fishing”, whereby derelict fishing gear becomes entangled on

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
			the mooring lines and has the potential to then entangle diving seabirds, as very difficult to quantify at this stage.
Seabirds (cormorant/shag, gulls and terns)	Creation of roosting habitat for birds due to presence of floating platforms and associated infrastructure	Operational	The introduction of floating platforms and associated infrastructure presents the opportunity for new roosting habitat which may be utilised by foraging birds. The offshore bird surveys will provide information to inform which species are present in the area.
Seabirds (tubenoses)	Attraction of nocturnal seabirds (shearwaters and petrels) to lighting on project infrastructure	Operational	The potential for nocturnal species such as petrels and shearwaters to be negatively affected (attraction or disorientation) by lighting associated with project infrastructure is unknown and should be considered as part of the EIA process.
All coastal and terrestrial birds	Direct loss of breeding, roosting and foraging habitat due to the placement of project infrastructure	Construction Operational Decommissioning	The footprint of the onshore works may result in loss of breeding, foraging or roosting habitat. Onshore surveys will be required to determine which species and habitats are present and to inform placement and routing of infrastructure to minimise effects.
All coastal and terrestrial birds	Disturbance (noise and visual) to birds from installation and decommissioning activities	Construction Decommissioning	Construction activities for the onshore works may result in potential disturbance to breeding, foraging or roosting birds. Construction and decommissioning activities will be of limited duration and any disturbance effects will be temporary. Onshore surveys will be required to determine which species are present and to inform placement and routing of infrastructure to minimise effects.
All coastal and terrestrial birds	Displacement of birds from breeding, foraging or roosting areas due to effective loss of habitat if birds avoid the area due to the physical presence of	Operational	The presence of the onshore substation and associated maintenance activities may result in the displacement of breeding, foraging or roosting birds within the surrounding area. Onshore surveys will be required to determine which species are present and to inform placement and routing of infrastructure to minimise effects.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
	project infrastructure and maintenance activities		
Biological environment – Terrestrial Ecology			
Sand dunes	Direct disturbance and loss of habitat within the dune system due to the installation / decommissioning of onshore cable route and associated working areas.	Construction	Both areas of dunes within the study area are designated features, part of the SAC and SSSI, and further information on landfall and construction method is required before understanding the significance of impact.
Vegetated sea cliffs and slopes (maritime and dry heath)	Damage, disturbance and loss of cliffs, grassland and associated species through the installation of onshore cable and disturbance from working areas.	Construction	The cliffs and maritime grassland are sensitive to disturbance, and slow to recover, so any level of disturbance may be considered significant. These habitats are features of the SAC and SSSI and further assessment is required.
Calcareous grassland	The overland installation of the onshore cable from landfall may disturb, damage or result in the loss of areas of grassland.	Construction	Large areas of grassland may be affected depending on the final route. Due to the sensitive nature of this habitat and protected status further assessment is required.
Neutral unimproved grassland	Installation of the onshore cable route may result in the direct disturbance, damage or loss of areas of grassland. Lay down areas of associated works may also cause harm.	Construction	The cable route from landfall may result in a significant effect on this SSSI feature. Due to the sensitivity of this habitat further information is required to assess impacts.

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Semi-natural broadleaved woodland	Significant disturbance, damage and loss may occur as a result of the installation or decommission of the onshore cable route through an area of woodland. Damage from lay down areas or associated works may also occur.	Construction	If the route or areas disturbed by landfall coincide with areas of woodland it is likely to result in significant impacts which require further assessment once the scheme is finalised.
Ponds and lakes	No direct effect expected on ponds or lakes, although disturbance or damage to associated habitats may arise from excavations and installation of onshore cable route. Pollution incidences may also occur on connected watercourses.	Construction	Although no ponds or lakes have been identified at the potential landfall sites, onshore cable routes would seek to avoid lake or pond features. Further information is required prior to scoping out any significant effect.
Streams and rivers	Direct disturbance and damage to streams, rivers and associated habitats may arise during the installation of the onshore cable or, indirectly, from work on hydrologically connected habitats.	Construction	Watercourses and associated habitats and species are vulnerable to disturbance and damage, sometimes taking a long time to recover. Further detailed assessment is required to establish the significance of any effect.
Wetlands	No direct impacts are expected to areas of wetland, however indirect impacts such as pollution incidences may occur on connected watercourses.	Construction	No areas of wetland are expected to be directly affected, however a final assessment will be undertaken once the final route is confirmed.

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Improved grassland (pasture)	Excavation of the onshore cable route is likely to directly disturb improved grassland and associated habitats such as field margins. Field margins may be severed or temporarily damaged depending on construction method.	Construction	Improved grassland is of negligible value, however associated habitats such as field margins are of intrinsic value at a local and regional level and further assessment is required.
Cultivated land	Excavation of the onshore cable route is likely to directly disturb cultivated land and associated habitats such as field margins. Field margins may be severed or temporarily damaged depending on construction method.	Construction	Cultivated land is of negligible value, however associated habitats such as field margins are of intrinsic value at a local and regional level and further assessment is required.
Roadside verges	Disturbance, severance, or temporary loss arising from the installation of the onshore cable route, will direct affect roadside verges. Damage may also be caused in accessing sites during construction.	Construction	Roadside verges are a valuable habitat and severance of the verge network may result in significant impacts if this feature is the only means of connectivity through the area. Further assessment is required once final route and construction methodology is known.
Greater and lesser horseshoe bats	It is not expected that roost sites will be directed impacted; however, should cable installation run close to bunkers or caves, indirect disturbance may occur. Direct and indirect impacts will affect foraging and commuting bats during all	Construction Operational Decommissioning	Both species are features of the SAC and exceptionally vulnerable to severance of connectivity and disturbance from noise and light. Detailed assessment will be required once the onshore cable route and onshore substation location have been finalised, to understand the significance of effect.

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	phases of the Project. These relate to severance of connectivity to habitat features such as hedgerows and woodland from the cable installation; temporary disturbance or loss of foraging habitat as a result of cable installation; and increased noise, light and vibration from construction, decommissioning and during the operation of the substation.		
Myotis bat species	As above	Construction Operational Decommissioning	Although not features of the SAC, these species are Annex IV species vulnerable to severance of connectivity and disturbance from noise and light. Detailed assessment will be required once the onshore cable route and onshore substation location have been finalised, to understand the significance of effect.
Barbastelle bat	As above	Construction Operational Decommissioning	As above
Otter	Disturbance or damage to habitats supporting resting or breeding otters may occur at landfall sites and along the cable route. There is a risk of pollution incidences on hydrologically connected features affecting foraging otters, and also an increase in noise, lighting, and vibration	Construction Operational Decommissioning	Otters are an SAC feature and vulnerable to habitat fragmentation, loss of connectivity and pollution. Depending on the final landfall, onshore cable route, and onshore substation, the effects of the Project may be significant. Further assessment will be required.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
	during construction, operation and decommission.		
Dormouse	Disturbance to habitat, severance of connectivity and a loss of foraging habitat may occur as a result of cable route or the substation siting.	Construction Operational Decommissioning	There are no records of dormice in the study area and limited suitable habitats, with the closest record 10 km from the site. Subject to further consultation regarding a reported possible dormouse nest near Pembroke Power Station, however impact is anticipated.
Adder	Adders are sensitive to habitat fragmentation and disturbance and the installation of the onshore cable route may disturb suitable habitats. Impacts may also arise at landfall sites and associated construction lay down areas.	Construction	Due to the potential cable route crossing valuable adder habitat, further assessment is required to understand the significance of the potential impact.
Great crested newt	Disturbance to habitat, severance of connectivity, and a loss of foraging habitat may occur as a result of cable route or the substation siting.	Construction Operational Decommissioning	There are no records of great crested newt in Pembrokeshire, and limited suitable habitats, therefore no impact is anticipated.
Marsh fritillary butterfly	Breeding habitat may be disturbed or lost during the installation of the cable route or from associated construction lay down areas.	Construction	Certain areas support marsh fritillary and until the final landfall and cable route are defined, it will not be possible to assess the significance of effect.
Shrill carder bee	Excavations and associated works from the onshore cable route may disturb and destroy	Construction	Shrill carder bee are exceptionally vulnerable to habitat loss and any disturbance may be considered significant. Further

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
	habitat supporting the shrill carder bee resulting in mortality or loss of feeding areas.		assessment is required once the onshore cable route / location of the onshore substation is finalised.
Petalwort	Excavations and associated works from landfall and the onshore cable route may disturb and destroy the dune habitat resulting in a loss of plants or habitat quality.	Construction	Petalwort are vulnerable to habitat loss, and disturbance may be significant. Further assessment is required once landfall and the onshore cable route / location of the onshore substation is finalised.
Badger	Disturbance to habitat, severance of connectivity and a loss of foraging habitat may occur as a result of cable route or the substation siting.	Construction Operational Decommissioning	Badger are vulnerable to habitat loss and disturbance may be significant. Detailed assessment will be required once the onshore cable route and onshore substation location have been finalised, to understand the significance of effect.
Human environment – Commercial Fisheries			
Commercial Fisheries	Loss / damage to fishing grounds (long term) due to presence of floating turbine anchors / cable protection (and associated reduction in revenue).	Construction Operational Decommissioning	Data have shown the offshore (array) part of the Study Area to be of lower importance in terms of landed weight and value than inshore regions, however, this area still represents a commonly used fishing ground by both UK and non-UK vessels.
Commercial Fisheries	Loss / damage to fishing grounds (long term) due to presence of cable (export) protection.	Construction Operational Decommissioning	Data have shown the inshore part of the Study Area to be an important region for commercial fishing. The final offshore cable route selected may pass close to / through inshore reef features which are known to represent important habitat for bass – a key target species for commercial and recreational fishermen.

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Commercial Fisheries	Restricted access to / displacement from fishing grounds (long term).	Construction Operational Decommissioning	Vessels may be restricted from accessing usual fishing grounds due to statutory exclusions, safety zones or avoidance of the area by fishing vessels due to safety reasons.
Commercial Fisheries	Reduction in water depth.	Construction Operational Decommissioning	Fishing activity may be displaced, or loss of grounds may occur due to safety, if a reduction in water depth results from installation of project infrastructure.
Commercial Fisheries	Contamination of fish stocks.	Construction Operational Decommissioning	Installation methods may result in sediment plumes and increased suspended sediment which may in turn impact upon fish stocks and water quality.
Commercial Fisheries	Snagging resulting from seabed obstruction.	Construction Operational Decommissioning	Fishing activity may be displaced, or loss of grounds may occur due to safety, if a seabed obstruction exists.
Intertidal Commercial Fisheries	Restricted access to / displacement from fishing grounds (temporary).	Construction Operational Decommissioning	Data has shown the inshore Study Area to be an important region for commercial fishing.
Human environment – Shipping and Navigation			
Recreational and commercial vessels	Interaction of Project vessels with commercial, fishing and recreational vessels.	Construction Operational Decommissioning	During the construction/decommissioning phase, the presence of installation vessels undertaking construction activities within the offshore Project Area has the potential to interfere with other marine users. During the operational phase, work boats within the Project Area may impact on other marine users. The significance of impact will be dependent on the construction port and selected landfall / cable route.
Recreational and commercial vessels	Impacts on vessel routes.	Construction Decommissioning	There are no transit routes currently passing through the offshore site which are likely to be displaced. However, there are

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
			transit routes running across the proposed export cable area which are likely to be displaced during the construction and decommissioning phases of the project including displacement due to avoidance of the area by vessels for safety reasons. There is also potential for extending transiting time for fishing vessels and vessels leaving / approaching Milford Haven from the south. The significance of impact will be dependent on the construction port and selected landfall/cable route.
Recreational and commercial vessels	Displacement of anchorages.	Construction Operational Decommissioning	Displacement of informal anchorages could result in hindrances for the shipping industry. The significance of impact will be dependent on the construction port and selected landfall / cable route.
Recreational and commercial vessels	Impacts on navigational safety.	Construction Operational Decommissioning	The installation of any export cable protection in nearshore regions may potentially reduce the navigable water depth within the Project Area. If cable armouring is required, this would further reduce the navigable water depth within the export cable corridor.
Recreational and commercial vessels	Increased collision risk with other marine users.	Construction Operational Decommissioning	The presence of additional vessels operating in the Project Area has the potential to increase vessel to vessel collision risk. The significance of impact will be dependent on the distance between construction port and location of selected landfall / cable route.
Recreational and commercial vessels	Increased collision risk with Project devices.	Construction Operational Decommissioning	The physical presence of structures within the Project Area has the potential to increase the vessel to structure collision risk for vessels, including those drifting or without power. The physical presence of structures within the Project Area also has the potential to cause visual intrusion and noise impacts to other vessels.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Recreational and commercial vessels	Potential collision between passing / work vessels and project infrastructure.	Construction Operational Decommissioning	Activities associated with the proposed Project may diminish emergency response capability (including Search and Rescue (SAR) and pollution response) within the proposed Project Area.
Recreational and commercial vessels	Interaction with subsea cables.	Construction Operational Decommissioning	The significance of impact will be dependent on the selected landfall / cable route. As part of embedded mitigation, planned cables will be either buried or protected by rock placement to ensure they do not pose a risk to anchoring or fishing gear within the area. The project will also include mitigation to ensure that they are maintained throughout the life of the project and do not become exposed.
Recreational and commercial vessels	Increased collision risk between other marine users.	Construction Operational Decommissioning	The presence of additional vessels operating in the Project Area and the physical presence of structures within the Project Area has the potential to squeeze small craft into the routes of larger commercial vessels.
Human environment – Marine Infrastructure and Other Users			
Military Activity	Disruption to existing MoD and Royal Navy activity in and around the Castlemartin range and surrounding sea area	Construction Operational Decommissioning	The exact scope for construction activity and, subsequently, fully operational WTGs to interfere with MoD operations (including radars, communications and surveillance systems) is currently unknown and will require further assessment within the EIA.
Unexploded Ordnance (UXO)	Interaction with UXO has the potential to cause risk to life and damage to ecological receptors	Construction Decommissioning	Due to the proximity of military activity there is potential for encountering UXO and as such, assessment will be required within the EIA.
Closed Disposal Sites	Risk of construction works / vessels creating direct impacts (disturbance of spoil material)	Construction Operational Decommissioning	The nearest closed disposal site is located within the Project area, within the south of the site. Direct impacts (disturbance of spoil material) will require further assessment within the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
	on known marine disposal sites.		
Open Disposal Sites	Risk of construction works / vessels creating direct impacts (disturbance of spoil material) on known marine disposal sites.	**Scoped Out**	The nearest open disposal site is located 19 km to the north of the offshore array area. As no project infrastructure will be located in this disposal site, no direct impacts (disturbance of spoil material) are predicted.
Ports and Harbours	Disruption to routine port operations via project-related activities.	Construction Operational Decommissioning	The exact scope of interference on existing port operations (including vessel movements; maintenance dredging) is not clear and will require further assessment within the EIA.
Cables	Damage to existing cables	Construction Operational Decommissioning	No active cables cross the offshore array area however the proposed export cable route would cross the 'Solas' telecommunication cable 'Tata Atlantic' telecommunication cable and Century Link's UK-Ireland Crossing. Construction activities for the proposed Project may interact with these existing cables and cause damage. Depending on export cable routing, there is also high potential for interaction with the Greenlink interconnector cable, potentially resulting in interference to the cable.
Aggregate Extraction	Potential impact on licensed marine aggregate activities	**Scoped Out**	No licensed marine aggregate activities occur within the study area so there is no scope for impacts.
Oil and Gas Operations	Potential impact on licensed oil and gas exploration activities	**Scoped Out**	No licensed oil and gas exploration activities occur within the study area so there is no scope for impacts.
Other Renewable Energy Projects	Potential adverse impacts on planned marine renewable energy projects in the Study Area	Construction Operational Decommissioning	The exact scope of interference on other planned marine renewables energy projects (PDZ; META; Bombora; Erebus) is not clear and will require further assessment within the EIA.

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Human environment – Aviation and Radar			
All aircraft	Increased collision risk due to offshore WTG infrastructure.	Construction Operational Decommissioning	Risk of collision due to interference with radar and communications systems.
Primary Surveillance Radar	Physical obstruction of WTGs and the generation of unwanted returns (returns that are not aircraft) to radar. Interference.	Construction Operational Decommissioning	Risk of collision due to interference with radar.
Aeronautical navigation aids and communication systems	Possibility of WTGs interfering with radio communication between Air Traffic Controllers and aircraft under their control.	Construction Operational Decommissioning	Risk of aircraft collision due to interference with communications systems.
Offshore helicopter operations (SAR)	Risk of interaction between SAR helicopter service and offshore infrastructure.	Construction Operational Decommissioning	Offshore search and rescue helicopter operations could be affected adversely by WTGs.
Human environment – Archaeology and Cultural Heritage			
Buried Archaeological /(Palaeo) Environmental Remains	Direct impacts on sites within the footprint of the proposed Project causing destruction or damage of the assets. Indirect impact associated with changes to marine and coastal processes	Construction Operational Decommissioning	High potential for an impact to be of permanent negative effect, and without mitigation would be of major significance. Exposure of buried remains following changes to marine or coastal processes could result in increased degradation. Conversely, burial of remains caused by changes to marine or coastal processes could be considered positive.
Maritime and Aviation Sites	Direct impacts on sites within the footprint of the proposed	Construction Operational Decommissioning	High potential for an impact to be of permanent negative effect, and without mitigation would be of major significance.

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	Project causing destruction or damage of the assets. Indirect impact associated with changes to marine and coastal processes.		Exposure of buried remains following changes to marine or coastal processes could result in increased degradation. Conversely, burial of remains caused by changes to marine or coastal processes could be considered positive.
Marine and Intertidal Heritage Assets	Direct impacts of sites within the footprint of the proposed Project. Indirect impacts associated with changes to marine and coastal processes.	Construction Operational Decommissioning	High potential for an impact to be of permanent negative effect, and without mitigation would be of major significance. Exposure of buried archaeological remains following changes to marine or costal processes could result in increased degradation of those remains. Conversely, increased burial of remains previously exposed to marine processes could be considered a positive impact.
Onshore Heritage Assets	Impacts to the setting of heritage assets.	Construction Operational Decommissioning	Potential that the introduction of a new development, with associated activities, could negatively affect the setting of heritage assets without mitigation.
Historic Landscape and Seascape	Changes to the historic character of the area.	Construction Operational	High potential that the introduction of a new development, with associated activities, could negatively affect the setting of the heritage asset without mitigation.
Current Archaeological Research in Wales	Potential positive impact of publishing fieldwork results and archaeologically assessed geophysical and geotechnical data, as well as any finds identified.	Construction	The acquisition of new information on shore and offshore through geophysical, geotechnical and fieldwork surveys could significantly contribute to the understanding of archaeology in the region.
Human environment – Land Use			
Settlements	Disturbance or limiting development through the	**Scoped Out**	It is not anticipated that landfall will affect any settlements. The onshore route will not pass through any settlements. The

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
	installation of onshore cable or siting of the substation.		substation may be visible from parts of Pembroke Dock, this is considered further under Section 6.8.
Industrial	Disturbance or limiting development through the installation of onshore cable or siting of the substation.	Construction Operational	None of the preferred landfall sites are anticipated to directly impact on the operation of business, industry or energy sites. The onshore cable route and substation location have yet to be finalised and although it is not anticipated they would interfere with the operation of any identified sites a further assessment will be undertaken once the preferred route is confirmed.
National Park	Disturbance and damage to the special qualities of the Park affecting management, natural beauty, wildlife and cultural heritage.	Construction Operational Decommissioning	Until landfall, onshore cable route and location of the substation have been confirmed there is potential for impact on land use within the National Park boundary and further assessment is required to establish the significance of resulting effects.
Military	Potential disruption and restriction of terrestrial military operations arising from the installation of the onshore cable route.	Construction Decommissioning	Until landfall and the onshore cable route have been confirmed there is potential for an impact on military operations and further assessment is required to establish the significance of resulting effects.
Agriculture	The preferred sites for landfall would not affect agricultural land however disruption and disturbance may arise from the installation of the onshore cable route and siting of the substation, and depending on the selected substation location there could be minor loss of agricultural land due to the development footprint.	Construction Operational Decommissioning	Until the onshore cable route and location of the substation have been confirmed there is potential for an impact agriculture and further assessment is required to establish the significance of the resulting effects.

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Human environment – Traffic and Transport			
Pedestrians, other road users and local communities	As a result of increased traffic there is potential for an associated increase in accidents and a reduced level of safety for road users and pedestrians.	Construction Operational Decommissioning	The potential for highway safety to be impacted may be significant and further assessment is required to understand the potential levels of traffic, duration of presence and the associated impact.
Pedestrians, other road users and local communities	Delays are likely to arise due to the installation of the onshore cable route	Construction Operational Decommissioning	The installation of the onshore cable route in the existing road network could cause significant delays and disruption. The road network from landfall to substation is predominantly narrow, in some places single carriageway, and although the area is not heavily populated it is a busy tourist destination. This consideration will be taken into account in the design iteration process for the onshore infrastructure, and further assessment will be required once the final onshore cable route is confirmed.
Pedestrians, other road users and local communities	Severance, of local communities to services and facilities may arise.	Construction Operational Decommissioning	The impact the Project would have will depend on the final onshore cable route and proposed landfall and substation locations. Further assessment is required once finalised to assess the level of impact.
Human environment – Seascape, Landscape and Visual Impacts			
Landscape Character of the PCNP	Adverse impact on landscape character of the PCNP from offshore WTGs and onshore substation.	Construction Operational Decommissioning	The study area has a high number of sensitive visual receptors. The EIA will need to carefully assess potential impacts.
Character of Registered Landscapes of	Registered Landscapes of Outstanding or Special Interest	Construction Operational Decommissioning	The EIA will need to carefully assess potential impacts on Registered Landscapes of Outstanding or Special Interest.

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Outstanding or Special Interest	lie in close proximity to proposed works.		
Regional Seascape Character	WTGs and associated offshore infrastructure would be new features in the seascape.	Construction Operational Decommissioning	The EIA will need to carefully assess potential impacts on SCAs due to sensitivity of these and the relatively unspoilt nature of the seascape off Pembrokeshire.
Users of the Pembrokeshire Coast Path and other PRoWs.	Adverse impact on visual amenity via all project phases.	Construction Operational Decommissioning	Users of the coast path and other PRoWs in the study area will be highly sensitive to visual impact as the existing, mainly undeveloped nature of this coastal area is one of the main reasons that users visit this area.
Heritage Coast: South Pembrokeshire; and Marloes and Dale	Installation and removal of infrastructure directly impacting features from cable	Construction Operational Decommissioning	Potential damage and loss of features.
Other coastal users, including beach / recreational users	Adverse impact on visual amenity via all project phases.	Construction Operational Decommissioning	Local beach users / recreational users may be sensitive to visual impacts and as such, detailed assessment will be required in the EIA.
Local residents	Adverse visual impact via construction works and final project infrastructure (WTGs offshore; onshore substation).	Construction Operational Decommissioning	Even though the study area has relatively small settlements and a small population level, when compared to other parts of Pembrokeshire, an assessment of potential visual impacts will still be required in the EIA.
Visitors to Lundy Island	Visual impact on seascape for visitors to Lundy Island.	Operational	Visitors to Lundy Island may visit to experience the clear seascape that exists around the Island. Scope for this to be affected by the WTGs will need to be assessed within the EIA.
Landscape Character of Gower AONB	N/A	**Scoped Out**	The Gower AONB is a highly sensitive receptor due to being designated for landscape. However, it is 87 km from the offshore array so significant effects on this AONB are not expected.

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Human environment – Underwater Noise and Vibration			
Ecological receptors, such as marine mammals and fish.	Disturbance to behaviour patterns, masking, hearing threshold shift, physical injury and physiological changes	Construction Operation Decommissioning	The majority of noise emissions from the Project are expected to produce noise and vibration levels that are not significant. Underwater noise emissions from any potential piling activity cannot be excluded from giving rise to potential significant effect at this stage. Underwater noise and vibration impacts on ecological receptors can be adverse and further assessment of all noise impact pathways is required to understand the significance of potential sources.
Human environment – Airborne Noise			
Onshore Ecological Receptors	Disturbance to behaviour patterns including nesting, roosting foraging and breeding arising from the installation of the onshore cable (including landfall) and onshore substation.	Construction Operational (substation only) Decommissioning	Onshore construction, operational and decommissioning phases have the potential to create noise and disturb ecological receptors including birds, bats and otters. As the onshore elements have yet to be finalised further assessment will be required to establish the significance of the effect.
Onshore Human Receptors	Noise disturbance arising during all phases of the project to onshore receptors such as residential areas and sensitive sites in the National Park.	Construction Operational (substation only) Decommissioning.	Onshore construction, operational and decommissioning phases have the potential to create noise and disturb human receptors such as residential areas, tourist destination and the Wales Coast Path. As the onshore elements have yet to be finalised further assessment will be required to establish the significance of the effect.
Offshore Ecological and Human Receptors	Noise disturbance arising during all phases of the project to offshore receptors.	**Scoped Out**	Limited airborne noise is predicted to be generated at any stage of the proposed Project; and there are also limited sensitive receptors to airborne noise in the offshore environment.
Human environment – Air Quality			

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Human Health	Impacts from dust and fine particulate matter may affect human health during the Project phases.	Construction Decommissioning	Potential increased dust particles created during construction may lead to impacts on human health.
	Human health impacts arising from vehicle emissions.	Construction Operational Decommissioning	An increase in vehicle movements caused, primarily, during construction, may increase pollutant concentrations. However, until the location of landfall, onshore cable route, and proposed site of the substation, are confirmed it is not possible to assess the significance of the effects.
Ecological Receptors	Impacts from dust and fine particulate matter; and vehicle emissions may impact ecological receptors during the Project phases.	Construction Operational Decommissioning	Ecological receptors, including features of designated sites that are sensitive to nitrogen or acid deposition, may be impacted by significant increases in dust or emissions. Further assessment will be required once the full extent of the Project is confirmed to understand the level of impact.
Human environment – Tourism and Recreation			
Recreational vessel activity (sailing, angling, diving, wildlife trips)	Obstruction / alteration to regular recreational routes via construction activity (including export cable installation). Obstruction to anchorages, marinas, slipways etc. during construction activity (including export cable installation). Displacement of vessels (long term) or temporary) due to Safety Zones during construction phase. Reduced access to preferred angling marks / impacts on target species.	Construction Operational Decommissioning	The offshore nature of the proposed Project means that scope for impacts on marine vessel users exists and will require assessment within the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Coastal recreational users	Disruption / reduced access to preferred areas for nearshore recreational users, including surfers, divers, swimmers.	Construction Decommissioning	Proposed landfall and nearshore cable installation works will create disruption during construction and decommissioning phases. The exact scale and significance will need to be assessed by the EIA.
Coastal tourism	Disruption / reduced access to beaches at proposed landfall locations.	Construction Decommissioning	Proposed landfall works will create temporary disruption on beach users and will require assessment within the EIA.
	Disruption / reduced access to Pembrokeshire Coast Path.	Construction Decommissioning	Proposed landfall works may require temporary disruption / diversion of the Pembrokeshire Coast Path. The exact scale and significance of this will need to be assessed within the EIA.
	Visual impact on tourists of construction works and operational scheme.	Construction Operational Decommissioning	Temporary visual impacts are expected during construction and decommissioning. During the operational phase, the distance offshore of the planned WTGs (>40 km), means that visual impacts on tourism are not expected. However, in the absence of visualisation data at this stage of the project, this potential impact is scoped in for assessment.
Terrestrial recreational users	Disruption to cyclists, walkers.	Construction Decommissioning	Construction of the onshore infrastructure (onshore cable, onshore substation) will potentially create impacts on cyclists, walkers in the study area. The exact scale and significance of these impacts will be assessed within the EIA.
Human environment – Socio-Economic			
Aging population	The proposed Project could offer attractive options for employment; for those of economically active age to move to the area.	Construction Operational Decommissioning	The in-migration of economically active population into Pembrokeshire would be considered a positive impact.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Economically active and employment	The proposed Project could create direct and indirect jobs via the Project, in terms of employment and supply chain opportunities, as well as safeguarding jobs in of existing areas of supply chain, ports and marine services.	Construction Operational Decommissioning	Job security and the creation of new jobs would be considered a positive socio-economic contribution.
Redress industry sectors	Create an increase in Professional roles and reduce the reliance on seasonal roles.	Construction Operational Decommissioning	Creating more diverse employment opportunities across the county would be considered a positive socio-economic contribution and result in an impact on local business and employment opportunities.
GVA and productivity	Increase productivity for the region, as long as supply chain benefits remain in the local economy.	Construction Operational Decommissioning	An objective of the Project, and aim for the developer, is to develop the local supply chain to support employment in the county; and although some elements of manufacture may have to be outsourced, where possible all resources will be sourced locally.
Welsh Index of Multiple Deprivation	Increase revenue opportunities within the region, bringing in more cashflow and contributing to more economic benefit. Over time, this may improve opportunities to address health and income aspects around the Pembroke Dock area (where infrastructure and current supply chain employment is based / could increase).	Construction Operational Decommissioning	As above, it is the intention for the Project to directly contribute to local employment and the local supply chain thus indirectly improving health and income.
Wellbeing of future generations goals -	Implementation of mitigation measures that strengthen the	Construction Operational Decommissioning	This is a tangible potential beneficial impact that links to Welsh legislation and should be assessed in detail within the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
green branding for locality	'green' credentials of the Project / locality will potentially lead to beneficial effects on the wellbeing of future generations for all phases.		
Level of commerce activity - green cluster creation	Implementation of measures that increase the understanding of the Project and establish a strong green cluster locally, will potentially lead to beneficial effects.	Construction Operational Decommissioning	This is a tangible potential beneficial impact that has been noted in other areas (e.g. Orkney) so should be assessed in detail within the EIA.
Training impacts - new skills and competence needs	The proposed Project will offer temporary employment opportunities both in terms of direct construction jobs and opportunities in the supply chain.	Construction Operational Decommissioning	This is a tangible potential beneficial impact and is very relevant to marine energy aspirations and strategy in Pembrokeshire. Therefore, it should be assessed in detail within the EIA.
Increased supply chain experience and case studies in relation to better marine renewables knowledge	Development of local supply chain will continue to progress and gain for their service portfolio from experience within the Project.	Construction Operational Decommissioning	As above.
Energy security - more green electricity, local supply, diversity of supply	The Project will help to beneficially support a transition to a more decentralised and decarbonised energy Model by showing how other types of renewable energy may be able	Operational	This is a tangible potential beneficial impact and is very relevant to marine energy aspirations and strategy in Pembrokeshire, Wales and the wider UK. Therefore, it should be assessed in detail within the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
	to contribute effectively to local, regional and UK energy supply.		

10 Appendices

Appendix A - Approach to Habitats Regulations Assessment

Appendix B – Designated Sites

Appendix C – Ornithology Designated Sites and Protected Species

End Page