Buchan Offshore Wind

Chapter 18 Climate Change

QMS Review

Name	Company	Date	Reviewed	Approved
RHDHV	Natural Power	24/06/2025	LJ	SM
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18.1 INTRODUCTION

18-1. Buchan Offshore Wind Limited (the “Applicant”) proposes to develop the Buchan Offshore Wind Farm (the “Project”). This chapter forms part of the Environmental Impact Assessment Report (EIAR) for the Proposed Offshore Development. The purpose of the EIAR is to provide the decision-maker, stakeholders and all interested parties with the environmental information required to assess the likely significant effects resulting from the Proposed Offshore Development, as required by the EIA Regulations.

18-2. This EIAR chapter describes the potential impacts of the Proposed Offshore Development’s Offshore Generation Infrastructure located seaward of Mean High Water Springs (MHWS) and Offshore Transmission Infrastructure, on climate change during the construction, operation and maintenance, and decommissioning phases and assesses any likely significant effects arising therefrom and discusses appropriate mitigation and monitoring as required to address any likely significant effects.

18-3. The Proposed Onshore Development, which includes the Onshore Transmission Infrastructure of the Project, located landward of Mean Low Water Springs (MLWS), is considered in this chapter in relation to the greenhouse gas (GHG) assessment only. This is because both the onshore and offshore components of the Project are integral to the delivery of electricity to the National Electricity Transmission System (NETS). Therefore, the Project’s total GHG emissions must be considered and presented as a whole. The Proposed Onshore Development is subject to a separate application, which will be submitted by the Applicant to Aberdeenshire Council.

18-4. This EIAR chapter differs from the assessments presented in the other EIAR chapters, as four individual assessments associated with the topic of climate change have been undertaken, as follows:

- a whole lifecycle GHG assessment (i.e. carbon assessment) which evaluates the Project’s impact on climate change. This assessment quantifies the anticipated GHG emissions released from activities during the construction (and pre-construction), operation and maintenance, and decommissioning phases of the Project as a whole, which includes both the Proposed Offshore Development and the Proposed Onshore Development. The GHG assessment evaluates the contribution of the Project to national and regional GHG emissions in Scotland and the UK, and compares its net effect against a ‘do nothing’ baseline scenario;
- a Blue Carbon assessment, which assesses the potential impacts of the Proposed Offshore Development on Blue Carbon habitats and the release of stored carbon, or changes to carbon sequestration rates caused by disturbance or loss of seabed habitat / sediments;
- a climate change resilience (CCR) assessment, which evaluates the resilience of the design and infrastructure of the Proposed Offshore Development to the projected impacts of climate change throughout its lifetime; and
- an in-combination Climate Change Impact (ICCI) assessment, which assesses how climate change may impact the Proposed Offshore Development’s effects on the surrounding environment, based on the predicted impacts identified in other technical topic chapters of the EIAR.

18-5. The ICCI assessment is presented as a standalone report in **Volume 3, Appendix 18.2: In-combination Climate Change Assessment**.

18-6. **Section 18.16** of this EIAR chapter provides a summary of the impact assessments and confirms the likely significance of residual effects related to climate change after mitigation and/or monitoring measures have been considered.

18-7. The assessments set out in this EIAR Chapter should be read in conjunction with the following linked and supporting chapters:

- Volume 2, Chapter 6: Marine and Coastal Physical Processes;
- Volume 2, Chapter 7: Benthic and Intertidal Ecology; and
- Volume 2, Chapter 14: Major Accidents and Disasters.

18-8. Additional information to support the assessments includes:

- Volume 3, Appendix 18.1: Greenhouse Gas Assessment Methodology; and
- Volume 3, Appendix 18.2: In-combination Climate Change Impact Assessment

18.2 PURPOSE OF THIS CHAPTER

18-9. The primary purpose of the EIAR is defined in **Volume 1, Chapter 1: Introduction**.

18-10. It is intended that the EIAR will provide Scottish Ministers, statutory and non-statutory stakeholders with sufficient information required to assess the likely significant effects of the Proposed Offshore Development associated with the construction, operation and maintenance, and decommissioning phases on the receiving environment.

18-11. The objectives of this chapter are to:

- define legislation, guidance, and policy documents relevant to climate change;
- provide an overview of consultation activities and present the responses relevant to climate change;
- present the methodology and significance criteria used in the impact assessment and provide definitions of the scope of the Study Areas;
- define the existing environment in relation to each assessment considered in the Climate Change chapter;
- assess the potential impacts and any resulting likely significant effects that activities associated with any stage of the Project may have on climate change from direct, indirect, and cumulative sources;
- assess the Proposed Offshore Development's vulnerability to climate change during the construction, operation and maintenance, and decommissioning phases;
- discuss appropriate mitigation and monitoring as required to address any likely significant effects; and
- describe any potential cumulative, transboundary impacts and inter-relationships on climate change.

18.3 LEGISLATION, POLICY AND GUIDANCE

18-12. A summary of legislation, policy, and guidance documents directly relevant to the climate change topic is presented in the following sections and have been referred to as appropriate in the characterisation of the baseline and the impact assessment. Overarching information in relation to the legal framework for the Proposed Offshore Development is provided in **Volume 1, Chapter 2: Legislation and Policy** of the EIAR.

18.3.1 Legislation

18-13. All legislation directly applicable to the Climate Change topic is illustrated in **Table 18-1.**

Table 18-1 Legislation Relevant to Climate Change

Legislation	Summary	Relevance to this Chapter
GHG Assessment		
The United Nations Framework Convention on Climate Change (UNFCCC), 1992	The UNFCCC is an international treaty which established a global climate governance framework and solidified climate change as an agenda item for future agreements and policies. The UNFCCC facilitated intergovernmental climate change negotiations such as the Conference of the Parties (COP).	The UK's obligation under the UNFCCC is implemented through the Climate Change Act 2008, which outlines commitments to reducing GHG emissions. A summary of the Climate Change Act 2008 is provided below. The contribution of the Project to the UK's statutory commitments in respect of GHG emissions is assessed in this chapter.
The Kyoto Protocol 1997	Following the UNFCCC, the Kyoto Protocol committed industrialised countries to limit and reduce their GHG emissions in accordance with individual targets to reduce the rate and extent of global warming. Annex A of the Kyoto Protocol defined the key GHGs, as follows: • Carbon dioxide (CO_2); • Methane (CH_4); • Nitrous oxide (N_2O); • Hydrofluorocarbons (HFC); • Perfluorocarbons (PFC); • Sulphur hexafluoride (SF_6); and • Nitrogen trifluoride (NF_3).	The UK's obligation under the Kyoto Protocol is implemented through the Climate Change Act 2008 which outlines commitments to reducing GHG emissions. The impact of the Project on the UK's statutory commitments in respect of GHG emissions is assessed in this chapter.
Paris Agreement 2015	The Paris Agreement, adopted during the 21st United Nations Climate Change Conference of the Parties (COP21) in 2015, is a legally binding international treaty aimed at addressing climate change, which the UK signed in 2016. The Paris Agreement commits all parties to the goal of limiting global warming to well below 2°C, preferably to 1.5°C, compared to pre-industrial levels. The Paris Agreement requires all parties to	As a response to the 1.5°C global warming target as part of the Paris Agreement, the Intergovernmental Panel on Climate Change (IPCC) advised that global emissions needed to reach net zero by around 2050 for this to be achievable. Subsequent updates to the UK's national emission targets have been made with consideration of

Legislation	Summary	Relevance to this Chapter
	submit plans to reduce their emissions (along with other climate action) every five years, starting in 2020.	this target, including the 2019 amendment to the 2008 Climate Change Act to change the target to achieve net zero emissions by 2050. The Sixth and Seventh Carbon Budgets were the first to be set following the adoption of the net zero target, which as stated in **Table 18-2**, are considered as part of the significance criteria for the GHG assessment presented in this EIAR Chapter in **Section 18.12.1**
The Climate Change Act 2008, Climate Change (Scotland) Act 2009, the Climate Change (Emissions Reduction Targets) (Scotland) Act in 2019, and the Climate Change Act 2008 (2050 Target Amendment) Order 2019	The Climate Change Act 2008 provides the legal basis for the UK's long-term response to tackling climate change. The 2050 Target Amendment Order, introduced in 2019 revised the UK's target to net zero by 2050, with an interim target of 78% emission reduction by 2035 compared to 1990 levels. The Act requires the UK Government to set legally binding Carbon Budgets to limit GHG emissions in a given time period. These budgets are set by the Climate Change Committee (CCC) in five-year periods, and are set out in **Table 18-2**. Scotland has its own distinct climate change legislation, the Climate Change (Scotland) Act 2009, which was amended by the Climate Change (Emissions Reduction Targets) (Scotland) Act in 2019. Scotland has committed to achieving net zero by 2045..	The impact of the Project to Scotland meeting its net zero targets and its obligations set out in the UK Carbon Budgets is considered as part of the GHG assessment in this EIAR chapter in **Section 18.12.1**
The Climate Change (Emissions Reduction Targets) (Scotland) Act 2024	The Climate Change (Emissions Reduction Targets) (Scotland) Act 2024 modifies the Climate Change (Scotland) Act 2009 to introduce limits on the amount of GHGs emitted in Scotland over a five-year period. This replaces the requirement for annual targets as outlined in the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019.	The impact of the Project to Scotland meeting its net zero targets and its obligations set out in the Scotland's Carbon Budgets is considered as part of the GHG assessment in this chapter in **Section 18.12.1**.
Blue Carbon Assessment		
Marine (Scotland) Act 2010	This act provides a framework for marine planning and conservation within inshore Scottish waters, including the protection	To meet the requirements of the Marine (Scotland) Act 2010, the Blue Carbon assessment has

Legislation	Summary	Relevance to this Chapter
	of marine habitats and ecosystems. Under section 21 of the Marine (Scotland) Act 2010, the Proposed Offshore Development requires a Marine Licence for marine licensable activities below MHWS.	been undertaken to align with the requirements of Scotland's National Marine Plan, which serves as the implementation framework for the Marine (Scotland) Act 2010. **Section 18.12.2** outlines how the climate-related requirements outlined in Scotland's National Marine Plan, including consideration for natural carbon sinks, are relevant for the Blue Carbon assessment.
CCR Assessment		
The Climate Change Act 2008 and Climate Change (Scotland) Act 2009	The Climate Change Act 2008 requires the UK Government to undertake a Climate Change Risk Assessment (CCRA) every five years and identify key climate risks and opportunities to national communities and economic sectors. The Climate Change (Scotland) Act 2009 poses a similar requirement for the preparation of strategic programmes for climate change adaptation following the publication of each UK CCRA. The third UK CCRA was published in 2022, followed by the third National Adaptation Programme (NAP), which outlines priority adaptation actions to be taken to address climate risks which may affect the natural environment, infrastructure, communities and the built environment, health, business and industry and international affairs. The third NAP covers key actions for 2023 to 2028 and includes the UK's fourth Strategy for Climate Adaptation Reporting. The Scottish Climate Change Adaptation Programme (SCCAP) 2019-2024 identifies specific actions for Scotland, including a need for resilient infrastructure systems.	The CCR assessment, provided in **Section 18.12.3** in this chapter, presents the risks of climate change to the Proposed Offshore Development.

Legislation	Summary	Relevance to this Chapter
Marine and Coastal Access Act 2009	The Marine and Coastal Access Act 2009 provides devolved authority to Scottish Ministers for marine planning and conservation powers in the Scottish Offshore Region (from 12 to 200 nautical miles (nm).	The CCR assessment detailed in **Section 18.12.3** has been implemented in alignment with the UK Marine Policy Statement (MPS), which is the implementation framework set out to enact the requirements of the Marine and Coastal Access Act 2009**.**

18-14. As discussed in **Table 18-1**, the UK has established Carbon Budgets which provide a legally binding five-year limit for GHG emissions in the UK. There are currently six Carbon Budgets that have been placed into legislation and the seventh Carbon Budget has been proposed by the CCC in February 2025 (Climate Change Committee, 2025a) and is awaiting acceptance and endorsement into law by the UK Government. The legislated and proposed UK Carbon Budgets are outlined in **Table 18-2**.

Table 18-2 UK Carbon Budgets (2008 to 2042).

UK Budget	Period	Carbon Budget Level (Mt CO_2e)	Reduction Below 1990 Levels	
			UK Targets	Achieved by the UK
1st Carbon Budget	2008 to 2012	3,018	25%	30%
2nd Carbon Budget	2013 to 2017	2,782	32%	38%
3rd Carbon Budget	2018 to 2022	2,544	38% by 2020	44%
4th Carbon Budget	2023 to 2027	1,950	52% by 2025	-
5th Carbon Budget	2028 to 2032	1,725	58% by 2030	-
6th Carbon Budget	2033 to 2037	965	78% by 2035	-
7th Carbon Budget	2038 to 2042	535	87% by 2040	-

18-15. The CCC have published recommended Scotland's Carbon Budgets which is awaiting acceptance and endorsement into law by the Scottish Government (Climate Change Committee, 2025b). The proposed Scottish Carbon Budgets are outlined in **Table 18-3**.

Table 18-3 Proposed Scottish Carbon Budget (2026 to 2045)

Scottish Budget	Period	Carbon Budget Level (Mt CO_2e)	Reduction Below Scottish 1990 Levels
1st Carbon Budget	2026 to 2030	175	57%
2nd Carbon Budget	2031 to 2035	126	69%
3rd Carbon Budget	2036 to 2040	81	80%
4th Carbon Budget	2041 to 2045	24	94%

18.3.2 Policy

18-16. All policy directly applicable to climate change is illustrated in **Table 18-4.**

Table 18-4 Policy Relevant to Climate Change

Policy	Summary	Relevance to this Chapter
General		
Aberdeenshire Council Local Development Plan (Aberdeenshire Council, 2023)	The Aberdeenshire Local Development Plan makes up the statutory development plan for the region and provides specific information on how the principles established in the 2020 Strategic Development Plan will be applied at a local level. Policy C2 Renewable Energy in the plan outlines Aberdeenshire Council's support of renewable energy projects including wind energy projects. The policy provides advice for the various parameters for which proposed developments will be assessed including, developing in appropriate locations with suitable designs, considering renewable energy targets, GHG emissions and carbon rich soils.	The Aberdeenshire Local Development Plan is policy applicable to the Proposed Onshore Development application. The GHG and Blue Carbon assessments presented in this chapter account for GHG emissions resulting from the Project and, and their impact on meeting the UK's and Scotland's emission reduction targets.. The methodology aligns with Aberdeenshire Council's assessment criteria for renewable energy developments, which include the consideration of climate change and GHG emissions.
National Planning Framework 4 (Scottish Government, 2023)	Scotland's fourth National Planning Framework (NPF4) sets out the national spatial strategy up to 2045, which guides infrastructure projects on principles and priorities. NPF4 supports developments that enable decarbonisation through the provision of renewable, low-carbon and zero emission technologies (Policies 1 and 11). In addition, NPF4 requires developments to minimise their lifecycle GHG emissions as far as possible (Policy 2). As a long-term vision for spatial development, NPF4 supports the enhancement of the climate resilience of existing and future developments. NPF4 requires developments to be sited and designed to adapt to current and future risks from climate change (Policy 2).	The NPF4, which is applicable policy for the Proposed Offshore Development and Proposed Onshore Development supports renewable energy development and requires the assessment of GHG emissions associated with development. Lifecycle emissions for the Project have been quantified as part of the GHG assessment presented in **Section 18.12.1** of this chapter. The resilience of the Proposed Offshore Development and the intertidal region to the projected impacts of climate change is considered as part of the CCR assessment presented in **Section 18.12.3** of this chapter.
Scotland's National Marine Plan (NMP) (Scottish Government, 2015)	Scotland's NMP was adopted to implement the Marine (Scotland) Act 2010 and covers the management of Scottish inshore water (out to 12 nm) and offshore water (12 to 200 nm). It provides an overarching framework for the sustainable use of Scotland's marine area. The plan includes the general planning principle, GEN 5 Climate change, which requires that marine planners and decision makers act in a way that mitigates and adapts to climate change. This includes seeking to facilitate the transition to a low carbon economy and giving sufficient regard to the impacts of climate change through considering ways to reduce GHG emissions, including the appropriate design and siting of developments, the use of technology and equipment, and giving consideration to the vulnerability, scale and longevity of an operation. The marine planning authorities require satisfaction that adequate risk management and contingency plans are in place, particularly in relation to potential changes in sea temperatures, sea level rise, storminess, and extreme water levels, using the best scientific evidence available at the time. The general principle also outlined the consideration for reducing human pressure and safeguarding ecosystem services such as coastal protection and natural carbon sinks (e.g. seagrass beds, kelp and salt marsh).	Scotland's NMP is policy that is only applicable to the Proposed Offshore Development. The GHG and Blue Carbon assessments presented in **Sections 18.12.1** and **18.12.2**, consider the impact of the Proposed Offshore Development to climate change and the impacts on natural carbon sinks, respectively. The CCR assessment presented in **Section 18.12.3** considers the vulnerability of the Proposed Offshore Development to future climate change. Each assessment considers embedded mitigation as appropriate, which is detailed in **Section 18.11**.
Sectoral Marine Plan for Offshore Wind Energy (Scottish Government, 2020)	The Sectoral Marine Plan for Offshore Wind Energy provides a strategic framework for developing offshore wind in Scottish waters. It guides seabed leasing under the ScotWind Leasing Round, supporting Scotland's climate and	The Sectoral Marine Plan for Offshore Wind Energy is policy that is applicable to the Proposed Offshore Development. The GHG and Blue Carbon assessments presented in **Sections 18.12.1** and **18.12.2**, consider

Policy	Summary	Relevance to this Chapter
	energy goals. The plan identifies suitable areas for development, aiming to minimise environmental impact and maximise economic benefits Aligned with Scotland's National Marine Plan and the UK Marine Policy Statement, it integrates national and regional policies to promote sustainable offshore wind expansion.	the impact of the Proposed Offshore Development to climate change and its impact on meeting the UK's and Scotland's emission reduction targets.
GHG assessment		
The Climate Change Plan, Third Report on Proposals and Policies (2018-2032) (Scottish Government, 2018), and Updated to the Climate Change Plan 2018 – 2032 (Scottish Government, 2020a)	The Scottish Government publishes Climate Change Plans to set out the pathway to achieving its GHG emission reduction targets per the Climate Change (Scotland) Act 2009. The most recent version, the 2018-2032 update, includes the Offshore Wind Policy Statement that supports the development of between 8 to 11 GW of offshore wind capacity by 2030.	Emissions associated with the Project and its contribution to achieving national emission reduction targets are considered as part of the GHG assessment presented in **Section 18.12.1** of this chapter.
The UK Net Zero Strategy 2021 (Department for Business, Energy and Industrial Strategy (BEIS), 2021)	The UK Net Zero Strategy and British Energy Security Strategy apply to Scotland and provide a national commitment to the provision of low-carbon, secure and affordable energy sources, including an ambition to deliver up to 50 GW of offshore wind capacity by 2030.	The UK's commitment to the provision of low-carbon energy sources and the Project's contribution to achieving this goal are considered as part of the GHG assessment presented in **Section 18.12.1** of this chapter.
British Energy Security Strategy, 2022 (BEIS, 2022)		
UK Climate Change Strategy 2021 – 2024 (HM Government, 2021)	The latest UK Climate Change Strategy aids UK exporters and suppliers through the transition to net zero emissions by increasing support to clean growth and climate adaptation, reducing GHG emissions and understanding and mitigating climate-related financial risks. The Strategy highlights the importance of transforming the financial system to boost innovation and transition away from high carbon sectors.	The UK's commitment to the provision of low-carbon energy sources, net zero and the Project's contribution to achieving this goal are considered as part of the GHG assessment presented in **Section 18.12.1** of this chapter.
Carbon Budget Delivery Plan (HM Government DESNZ, 2023)	The Carbon Budget Delivery Plan 2023, set by the UK Government, outlines the plans to enable the delivery of the 4th, 5th and 6th Carbon Budget as part of the requirements under the Climate Change Act 2008.	The impact of the Project on the UK's Carbon Budgets is considered as part of the significance criteria for the GHG assessment presented in **Section 18.12.1** of this chapter.
CCR assessment		
United Kingdom (UK) Marine Policy Statement (MPS) (HM Government, 2011)	The UK MPS serves as the implementation framework for Section 44 of the Marine and Coastal Access Act 2009, guiding decisions that impact the UK's marine environment. It is closely aligned with Scotland's National Marine Plan to promote a coherent and sustainable approach to managing resources. This alignment ensures effective integration between marine and terrestrial planning, supporting Scotland's ambitions for renewable energy development and environmental protection. Section 2.6.7 of the UK MPS details the requirement for consideration of climate change adaptation and mitigation for marine planning and decision making.	The resilience of the Proposed Offshore Development to the projected impacts of climate change across the construction, operation and maintenance, and decommissioning phase including assessing likely and potential impacts from climate change is considered as part of the CCR assessment presented in **Section 18.12.3** of this chapter.
UK Climate Change Risk Assessment (CCRA3) (HM Government, 2022)	The third UK Climate Change Risk Assessment (CCRA3) report to Parliament outlines the UK government and devolved administrations' position on the key climate change risks and opportunities that the UK faces today. This is based on the Independent Assessment of UK Climate Risk, the statutory advice provided by the Climate Change Committee (CCC), which was commissioned by the UK government and devolved administrations.	The resilience of the Proposed Offshore Development to the projected impacts of climate change is considered as part of the CCR assessment presented in **Section 18.12.3** of this chapter.

18.3.3 Guidance

18-17. All guidance directly applicable to Climate Change assessments are listed below:

- GHG assessment
  - Institute of Environmental Management and Assessment (IEMA): Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2022);
  - PAS2080: Carbon Management in Buildings and Infrastructure (British Standards Institute (BSI), 2023);
  - The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (2015);
  - The Offshore Wind Industry Product Carbon Footprinting Guidance (The Carbon Trust, 2024); and
  - Environmental Impact Assessment (EIA) – Assessing effects of downstream scope 3 emissions on climate. Supplementary guidance for assessment the effects of downstream scope 3 emissions on climate from offshore oil and gas projects (2025)
- CCR assessment;
  - IEMA Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation (2020)

18.4 CONSULTATION

18-18. The Applicant has sought opinion and advice from key stakeholders through scoping and consultation regarding the EIA Scoping Report for the Proposed Offshore Development (SCOP 0031) (which was submitted to MD-LOT in October 2023). **Table 18-5.**

18-19. **Table 18-5** provides a summary of the key issues raised during the consultation process relevant to Climate Change and details how these issues have been considered in the production of this EIAR chapter.

18-20. Further detail on the Proposed Offshore Development's overall EIA stakeholder consultation process is presented in **Volume 1, Chapter 5: EIA Methodology** of the EIAR.

18-21. Additional consultation on the methodology for the GHG, Blue Carbon, CCR and ICCI assessments presented in the Climate Change Chapter was sought from MD-LOT, NatureScot, the Scottish Environment Protection Agency (SEPA) and Aberdeenshire Council through letters issued on the 21st of October 2024. The responses received from the consultations are detailed in **Table 18-5.**

Table 18-5 Consultation Relevant to Climate Change

Consultee	Date/Document	Summary	Relevance to this Chapter
Scoping Opinion (REF – SCOP 0031)			
MD-LOT	20 December 2023/ SCOP 0031	The Scottish Ministers are largely content with the approach to assessing climate change effects and GHG emissions outlined in Section 19 of the Scoping Report. The Scottish ministers highlighted that the GHG assessment should include consideration of emissions during the pre-construction, construction, operation and maintenance, and decommissioning phases, including the supply chain as well as benefits beyond the life cycle of the Proposed Offshore Development.	The GHG assessment presented in **Section 18.12.1** of this chapter quantifies emissions during the pre-construction, construction, operation and decommissioning phase of the Project. As detailed in **Volume 3, Appendix 18.1: Greenhouse Gas Assessment Methodology**, it is not possible to fully define the supply chain for the Project at this stage, and further refinement will occur as the design progresses. Therefore, assumptions regarding the supply chain, particularly regarding the source of materials have been made as part of the GHG assessment. These are detailed in **Section 18.7.4.** In addition, benefits beyond the lifecycle of the Project are considered in the support of the Project to Scotland's and the UK's carbon reduction targets detailed in S**ection 18.12.1.4**
MD-LOT	20 December 2023/SCOP 0031	The Scottish Ministers advised that the NatureScot representation regarding climate change and carbon costs should be fully considered with the EIA Report.	The GHG assessment presented in **Section 18.12.1** of this chapter quantifies emissions from each phase of the Project which fully considers carbon costs and benefits.
MD-LOT	20 December 2023/SCOP 0031	The Scottish Ministers advised that consideration should be given to impacts on Blue Carbon as a result of the Proposed Offshore Development, as well an expanded assessment for benthic ecology focusing on potential impacts on marine sediments.	The Blue Carbon assessment, presented in **Section 18.12.2** of this chapter considers potential impacts on Blue Carbon benthic habitats and sediment from activities associated with the Proposed Offshore Development.
NatureScot	17 November 2023/ SCOP 0031 Appendix 1	NatureScot advised that the impact of climate change effects should be considered in the futureproofing of the Proposed Offshore Development's design and with consideration for how climate stressors may work in combination with potential effects from the Proposed Offshore Development.	The impacts of climate change effects on the Proposed Offshore Development are considered in the CCR assessment shown in **Section 18.12.3** of this chapter.
NatureScot	17 November 2023/ SCOP 0031 Appendix 1	NatureScot advised that consideration should be given to the impacts on Blue Carbon and whether or not an assessment can be undertaken. Additionally, it should expand on the benthic ecology assessment to focus on the potential impacts of the Proposed Offshore development on marine sediments.	The Blue Carbon assessment, presented in **Section 18.12.2** of this chapter considers potential impacts on Blue Carbon benthic habitats and sediment from activities associated with the Proposed Offshore Development.
NatureScot	17 November 2023/ SCOP 0031 Appendix 1	NatureScot advised that the UK Climate Change Risk Assessment (CCRA3) should be considered to inform the assessment of climate change risks.	The CCR assessment presented in **Section 18.12.3** of this chapter, presents the assessment of climate change risks, which has considered the findings of CCRA3. Risks to offshore energy infrastructure from high and low temperature, wind, lightning, storms and cascading failures have been considered.
NatureScot	17 November 2023/ SCOP 0031 Appendix 1	NatureScot advised that detailed assessments may be required for the construction and decommissioning phases depending on the impacts assessment.	The CCR assessment presented in **Section 18.12.3** of this chapter, presents the assessment of climate change risks to the construction and decommissioning phases.
Other Relevant Consultation to Date – Consultation Letter			
NatureScot	18 November 2024 CNS / REN / OSWF / NE8 – Buchan – Pre-application	NatureScot agreed with the methodology for undertaking the assessment and highlight that databases and references should be listed to support the assessment.	The CCR assessment presented in **Section 18.12.3** has followed the methodology approach outlined in **Section 18.9.4**. The data sources for the assessment are highlighted in **Section 18.6.1**
NatureScot	18 November 2024 CNS / REN / OSWF / NE8 – Buchan – Pre-application	NatureScot advised that the UK Climate Change Risk Assessment (CCRA3) should be considered to inform assessments. NatureScot also acknowledge that high level CCR assessment will be undertaken for the construction and decommissioning phases but noted that detailed assessments may be required depending on the impact assessment of the climate hazards that the Proposed Offshore Development may be vulnerable to.	The CCR assessment presented in **Section 18.12.3** of this chapter, presents the assessment of climate change risks, which has considered the findings of CCRA3. Risks to offshore energy infrastructure from high and low temperature, wind, lightning, storms and cascading failures have been considered.
NatureScot	18 November 2024 /	NatureScot advised that to avoid any confusion, it would be useful to refer to "remineralisation potential" and "potential CO_2	The Blue Carbon assessment presented in **Section 18.12.2** of this chapter uses this terminology.

Consultee	Date/Document	Summary	Relevance to this Chapter
	CNS / REN / OSWF / NE8 – Buchan – Pre-application	production/emission" when discussing any potential disturbance.	
NatureScot	18 November 2024 / CNS / REN / OSWF / NE8 – Buchan – Pre-application	NatureScot highlighted the potential impact of onshore infrastructure on the foreshore and backshore areas given that Blue Carbon habitats exist around Scotland's coastline.	The onshore infrastructure is outside of the scope of the Blue Carbon assessment presented in **Section 18.12.2** of this chapter, and will be considered in the onshore EIAR which is subject to a separate onshore planning application to be submitted to Aberdeenshire Council.
NatureScot	18 November 2024 / CNS / REN / OSWF / NE8 – Buchan – Pre-application	NatureScot advised that saltmarsh and sand dunes are both features of Loch of Strathbeg SSSI as well as being Blue Carbon habitats and should be addressed within both the onshore and offshore EIA reports.	There are not anticipated to be any impacts to the Blue Carbon habitats within the of Loch of Strathbeg SSSI, as no open-cut trenching will be undertaken at in this area. This approach will avoid impacts to any sand dune habitats above MLWS. Therefore minimising the potential for disruption and the release of carbon from land use change. The potential for emissions from onshore land use change is discussed in **Section 18.9.2.1.**
NatureScot	18 November 2024 / CNS / REN / OSWF / NE8 – Buchan – Pre-application	NatureScot advised that scientific literature used to inform the Blue Carbon baseline should focus on Scottish Blue Carbon habitats, as global studies are not likely to be applicable to the coastal and marine environment in Scotland.	The Blue Carbon assessment presented in **Section 18.12.2** of this chapter uses literature predominantly based in Scotland as detailed in **Section 18.7.2**. Specifically, data for habitats within the Proposed Offshore Development Site has been obtained from Smeaton *et al.* 2021a.
NatureScot	18 November 2024 / CNS / REN / OSWF / NE8 – Buchan – Pre-application	NatureScot advised that whilst impacts will likely be greatest during the construction phase, [sediment] accumulation may occur during the operation and maintenance phase as the structures might enhance deposition of sediments.	The Blue Carbon assessment presented in **Section 18.12.2** of this chapter considers the impacts of each phase of the development on Blue Carbon habitats.
NatureScot	18 November 2024 / CNS / REN / OSWF / NE8 – Buchan – Pre-application	NatureScot advises that not all Blue Carbon stocks that are disturbed have remineralisation potential, therefore, the worst-case scenario should be applied, i.e. assuming that 100% of disturbed sedimentary carbon ends up as CO_2 flux to the atmosphere.	The Blue Carbon assessment presented in **Section 18.12.2** of this chapter has adopted a conservative approach by assuming that all disturbed sedimentary carbon is released as emissions. Additionally, the area in which sedimentary carbon is calculated covers the entirety of the Proposed Offshore Development Site.
NatureScot	18 November 2024 / CNS / REN / OSWF / NE8 – Buchan – Pre-application	NatureScot advises Smeaton *et al.* (2020) organic carbon density values by Folk sediment type should be used, in combination with the site-specific benthic survey data.	The Blue Carbon assessment presented in **Section 18.12.2** of this chapter uses organic carbon (OC) and inorganic carbon (IC) content data from Smeaton *et al.* (2021b) as this is the most recent data in the Study Area (i.e. The Moray Firth).
NatureScot	18 November 2024 / CNS / REN / OSWF / NE8 – Buchan – Pre-application	NatureScot advises that the Blue Carbon assessment presented should be transparent, utilising tables where appropriate to clearly display the quantitative breakdown for calculating total carbon stocks.	The Blue Carbon assessment presented in **Section 18.12.2** of this chapter provides a detailed methodology to ensure transparency.
SEPA	21 October 2024 / BOW-L-0297	SEPA had no advice on the Proposed Offshore Development but recommended consulting with MD-LOT.	Consultation has been undertaken with MD-LOT, as referenced in this table.

18.5 STUDY AREA

18-22. The spatial scale of the Study Areas for the climate change topic is specifically defined for each assessment. Each of the assessments' Study Areas include the Proposed Offshore Development Site, which includes:

- Array Area;
- Export Cable Corridor (ECC); and
- Landfall Area.

18-23. Further details on the Proposed Offshore Development including the key offshore components are set out in **Volume 1, Chapter 4: Project Description**.

18-24. Each of the four assessments considered in the Climate Change chapter have different methodologies and receptors and therefore have unique Study Areas. A summary of the Study Areas for the GHG, Blue Carbon and CCR assessments is presented below, and the ICCI assessment is presented and discussed in **Volume 3, Appendix 18.2: In-combination Climate Change Assessment**.

18.5.1 GHG assessment

18-25. The GHG assessment has been approached on a whole Project basis. To fully assess the potential impacts, emissions arising from activities for both the Proposed Offshore Development and Proposed Onshore Development need to be accounted for in the Study Area for the GHG assessment as detailed in **Section 18.1**.

18-26. All GHG emissions will affect the same receptor, the global atmosphere, as opposed to directly affecting any specific local receptor. Emissions which are released or avoided due to the Project will have the same effect on atmospheric GHG concentrations and its net effect on climate regardless of where they occur. Therefore, the Study Area for the GHG assessment is not geographically defined.

18-27. The key components of the Proposed Offshore Development, set out in **Volume 1, Chapter 4: Project Description**, are summarised as follows:

- Wind Turbine Generators (WTG) and associated supporting structures, including floating foundations;
- mooring systems and anchors;
- Inter-array cables (IAC);
- Offshore Substation Platforms (OSPs) and associated supporting structures, foundations and scour protection;
- offshore export cables;
- interconnector cables;
- Intermediate Reactive Compensation (IRC) platform; and
- seabed preparation including:
  - boulder clearance and Pre-Lay Grapnel Run (PLGR); and,

- pre-sweeping for sandwave and unexploded ordnance (UXO) clearance.

18-28. The key components of the Proposed Onshore Development are summarised as follows:

- Onshore Cable Route
- Onshore Substation; and
- Onshore Cable Circuits from the Onshore Substation to the Grid Connection Point.

18-29. The GHG assessment quantifies the direct and indirect emissions arising from the construction, operation and decommissioning of the Project (see **Table 18-20** for further details on the emission sources and lifecycle modules considered). The Study Area for the GHG assessment includes activities such as marine vessel movements, and those with no definable geographical boundary, such as the raw material extraction and manufacturing processes for infrastructure components.

18-30. Relevant 'upstream' emissions associated with the Project have been calculated through the inclusion of embodied carbon emissions associated with the use of materials. The Study Area for the GHG assessment also accounts for the provision of renewable energy to the UK NETS, and avoided emissions compared to other forms of generation. Downstream emissions beyond the provision of the UK NETS are outside of the system boundary for the assessment, as there are no prescribed end users of electricity generated by the Project, and therefore have not been considered in the assessment.

18-31. A graphical representation of the Project's boundary is provided in **Plate 18-1.**

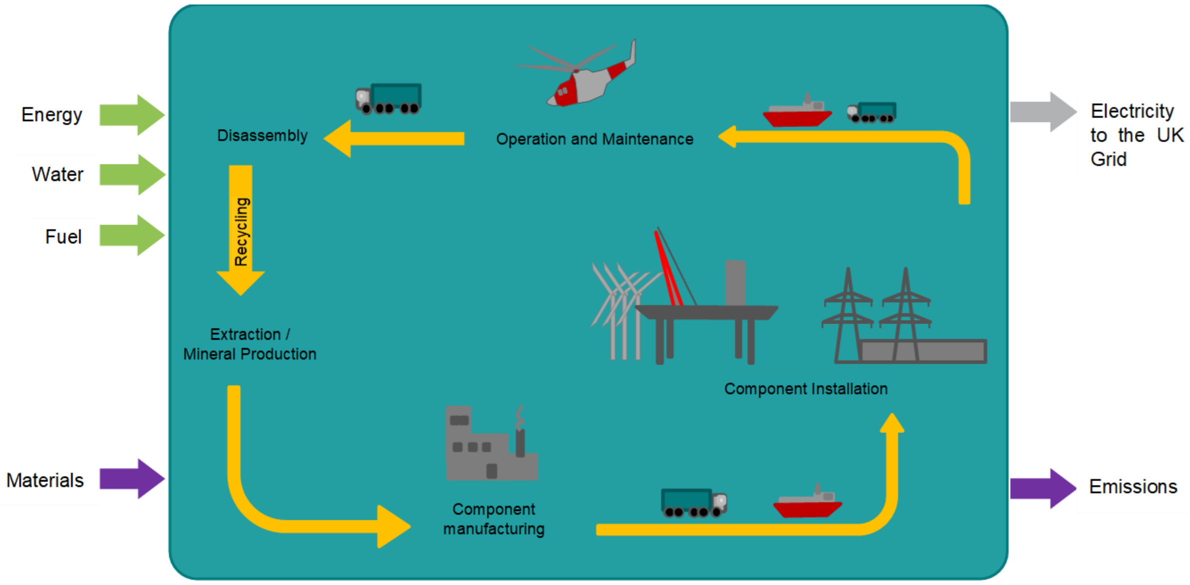


Plate 18-1 System Boundary for the Proposed Offshore Development GHG Assessment

18.5.2 Blue Carbon Assessment

18-32. The Blue Carbon assessment considers the following:

- the impact of the Proposed Offshore Development on Blue Carbon habitats; and

- the release of emissions associated with the disturbance of sediments resulting in the release of Blue Carbon.

18-33. The Proposed Offshore Development Site, as illustrated in Section 4.2.1 of **Volume 1, Chapter 4: Project Description** defines the Study Area for the Blue Carbon assessment. The Proposed Offshore Development Site includes the Array Area of up to 330 km^2, located approximately 75 km off the Aberdeenshire coast, and the ECC, which makes landfall in Rattray Bay, Aberdeenshire, with a total area of 86 km^2. The intertidal area, extending up to the MHWS is also within the Study Area for the Blue Carbon assessment.

18-34. The infrastructure and activities listed below have the potential to disturb the seabed and habitats containing Blue Carbon, therefore the Study Area for the assessment was defined by the following:

- WTG's and associated supporting structures, including floating foundations;
- mooring systems and anchors;
- IACs;
- OSPs and associated supporting structures, foundations and scour protection;
- offshore export cables;
- interconnector cables;
- IRC platform; and
- seabed preparation including:
- boulder clearance and PLGR; and,
- pre-sweeping for sandwave and UXO clearance.

18.5.3 CCR assessment

18-35. The Study Area for the CCR assessment is defined as the Proposed Offshore Development Site which includes the Landfall Area, Array Area, and the ECC seaward of MHWS. The Study Area includes the offshore components set out in **Volume 1, Chapter 4: Project Description**, and listed in **Section 18.5.1**.

18.6 METHODOLOGY TO INFORM BASELINE ENVIRONMENT

18-36. Baseline data to inform the Climate Change Chapter, including the GHG, Blue Carbon, CCR and ICCI assessments were collected using the following methods.

18.6.1 Desktop Study

18-37. Information on climate change within the Study Area was collated through a detailed desk-based review of existing studies and datasets which are summarised in **Table 18-6.**

Table 18-6 Key Sources of Climate Change Literature and Data

Literature/Data	Source	Year	Author
GHG Assessment			
DESNZ Greenhouse Gas Reporting Conversion Factors	https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2024	2024	DESNZ
DESNZ's Digest of UK Energy Statistics	https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2024	2024	DESNZ
DESNZ's Treasury Green Book Supplementary Guidance: Valuation of Energy Use and Greenhouse Gas Emissions for Appraisal	https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal	2023	DESNZ
UK Carbon Budget	https://www.legislation.gov.uk/uksi/2009/1259/made/data.pdf https://www.legislation.gov.uk/uksi/2011/1603/made https://www.legislation.gov.uk/uksi/2016/785/made https://www.legislation.gov.uk/uksi/2021/750/made/data.pdf	Various	Department of Energy and Climate Change (DECC) and Department for Business, Energy and Industrial Strategy (BEIS)
Climate Change Committee (CCC) Reducing the UK's Carbon Footprint Report	https://www.theccc.org.uk/wp-content/uploads/2013/04/Reducing-carbon-footprint-report.pdf	2013	CCC
Inventory of Carbon and Energy (ICE) Database v4.0	https://circularecology.com/embodied-carbon-footprint-database.html	2024	Circular Ecology and University of Bath
Lifecycle Greenhouse Gas Emissions of Utility Scale Wind Power	https://doi.org/10.1111/j.1530-9290.2012.00464.x	2012	Dolan and Heath
Life Cycle Costs and Carbon Emissions of Offshore Wind Power	https://www.pure.ed.ac.uk/ws/portalfiles/portal/19730442/Main_Report_Life_Cycle_Costs_and_Carbon_Emissions_of_Offshore_Wind_Power.pdf	2015	Thompson and Harrison
UK Territorial Greenhouse Gas Emissions National Statistics	Provisional UK greenhouse gas emissions national statistics 2023 - GOV.UK	2023	DESNZ
Scottish Greenhouse Gas Statistics	https://www.gov.scot/publications/scottish-greenhouse-gas-statistics-2022/	2023	Scottish Government
Scottish Energy Statistics	https://scotland.shinyapps.io/sg-scottish-energy-statistics/	2022	Scottish Government
Scotland's Carbon Budget	https://www.theccc.org.uk/publication/scotlands-carbon-budgets/	2025	CCC
Blue Carbon Assessment			
Blue Carbon review	https://digitalpublications.parliament.scot/ResearchBriefings/Report/2021/3	2021	Scottish Parliament

Literature/Data	Source	Year	Author
	/23/e8e93b3e-08b5-4209-8160-0b146bafec9d		
Scottish Blue Carbon - a literature review of the current evidence for Scotland’s Blue Carbon habitats.	https://www.nature.scot/doc/naturescot-research-report-1326-scottish-blue-carbon-literature-review-current-evidence-scotlands	2023	NatureScot (previously Scottish Natural Heritage)
Assessment of Carbon Budgets and potential Blue Carbon stores in Scotland's coastal and marine environment	https://www.nature.scot/doc/naturescot-commissioned-report-761-assessment-carbon-budgets-and-potential-blue-carbon-stores	2014	NatureScot (previously Scottish Natural Heritage)
Assessment of Blue Carbon Resources in Scotland's Inshore Marine Protected Area Network	https://www.nature.scot/doc/naturescot-commissioned-report-957-assessment-blue-carbon-resources-scotlands-inshore-marine	2017	NatureScot (previously Scottish Natural Heritage)
The United Kingdom’s Blue Carbon inventory: Assessment of Marine Carbon Storage and Sequestration Potential in UK Seas (Including Within Marine Protected Areas)	https://www.wildlifetrusts.org/sites/default/files/2024-09/UK%20assessment%20-%20scientific%20report.pdf	2024	The Wildlife Trusts, WWF, and the RSPB
Re-Evaluating Scotland’s Sedimentary Carbon Stocks	https://data.marine.gov.scot/sites/default/files/SMFS%201102.pdf	2020	Smeaton *et al.*
Marine Sedimentary Carbon Stocks of the United Kingdom’s Exclusive Economic Zone	Frontiers | Marine Sedimentary Carbon Stocks of the United Kingdom’s Exclusive Economic Zone	2021	Smeaton *et al.*
Supporting documentation: Sediment type and surficial sedimentary carbon stocks across the United Kingdom’s Exclusive Economic Zone and the territorial waters of the Isle of Man and the Channel Islands	Sediment type and surficial sedimentary carbon stocks across the United Kingdom’s Exclusive Economic Zone and the territorial waters of the Isle of Man and the Channel Islands | Marine Scotland Data Publications	2021	Smeaton *et al.*
CCR Assessment			
IPCC Sixth Assessment Report	https://www.ipcc.ch/assessment-report/ar6/	2023	IPCC
Marine Climate Change Impacts Partnership (MCCIP) Reports	https://www.mccip.org.uk/	2020	Various (incl. Horsburgh *et al.*, 2020; Masselink et. al., 2020; Wolf et. al., 2020)
Met Office UK Climate Averages and Regional Climate Summaries	https://www.metoffice.gov.uk/research/climate/maps-and-data/location-	1991-2020,	Met Office, 2024

Literature/Data	Source	Year	Author
	specific-long-term-averages/gfq84rw5n https://www.metoffice.gov.uk/research/climate/maps-and-data/regional-climates/index	1981-2010	
Met Office UK Climate Projections (UKCP) Database	https://ukclimateprojections-ui.metoffice.gov.uk/ui/home	Updated 2022	Met Office, 2022
Offshore Wind Climate Adaptation and Resiliency Study	https://jstor.org/stable/community.30049280	2021	Weisenfeld et. al., 2021

18.6.2 Baseline Surveys

18-38. No site-specific surveys have been undertaken to inform the GHG and CCR assessments. This is because adequate and sufficient receptor information and data related to these assessments can be readily collected through desktop study, consultation with relevant stakeholders, and is currently available due to suitable data throughout the east Scotland region.

18-39. The Blue Carbon assessment was informed by the **Volume 1, Chapter 7: Benthic and Intertidal Ecology**; specifically, the benthic habitat and sediment results from the Environmental Survey Report (**Volume 3, Appendix 7.1: Buchan Environmental Survey Report**). The survey was conducted in 2023 by Ocean Infinity on behalf of the Applicant to characterise the benthic environment of the Proposed Offshore Development Site including grab sampling, drop-down video recording, and water sampling. This allowed species abundance, richness, diversity, sediment composition and habitat type to be quantified across the benthos for the Proposed Offshore Development.

18-40. This data was then supplemented by carbon figures from Smeaton *et al.* (2021b), which is discussed further in **Section 18.7.2**.

18.7 BASELINE ENVIRONMENT

18-41. A summary of the baseline environment for the GHG, Blue Carbon and CCR and assessments are provided in the following sections. The baseline for the CCR assessment provides an overview of the likely climatic changes within the Study Area, which also informs the ICCI assessment, provided in **Volume 3, Appendix 18.2: In-combination Climate Change Assessment.**

18.7.1 GHG Assessment

18.7.1.1 Existing Baseline

18-42. To help determine the significance and contextualise the outcomes of the GHG assessment, consideration of a baseline or 'Do Nothing' scenario is required which assumes that the Project is not constructed. An overview of alternatives to the Project is presented in **Volume 1, Chapter 3: Site Selection and Consideration of Alternatives**.

18-43. The UK's NETS consists of different energy sources, including gas, nuclear, onshore and offshore wind, coal, bioenergy, solar and hydroelectric. However, it is recognised that the growth of renewable energy, coupled with a transition away from electricity generated using fossil fuels, is key to both Scotland's and the UK's energy policies and plans for economy-wide decarbonisation towards the long-term net zero targets. This approach aligns with UK and Scottish energy policies which outline that transition from fossil fuel generation to renewables is required in order for the UK to meet its emission reduction obligations. In addition, to meet future energy demands, it is anticipated that there will be a need to increase the volume of energy supplied, which should be driven by low carbon sources. Therefore, there will be increased electricity demand in the future, and if this cannot be met by renewable energy projects, it is reasonable to assume that generation from fossil fuel sources is likely to be required to meet the increase in demand.

18-44. Therefore, to evaluate the impact of the Project, it was assumed that the electricity it produces displaces electricity generated from 'natural gas' sources, as this is the most common form of energy source in new fossil fuel combustion plants (DESNZ, 2024a). It is however recognised that all new combustion power stations (at or above 300 MW) need to be constructed to be Carbon Capture Ready (CCR). Therefore, it was assumed that the naturas gas generation facilities were equipped with Carbon Capture and Storage (CCS).

Energy Produced by the Project

18-45. The anticipated energy produced by the Project, both annually and over its anticipated 35-year lifetime has been quantified in accordance with the approach outlined in The Carbon Trust's recently published offshore wind guidance (The Carbon Trust, 2024). This method is similar to the approach advocated in the RenewableUK (2024) guidance for offshore wind farms. Equation 1 (The Carbon Trust, 2024) provides the methodology for quantifying the net electricity generated by the Project over its lifetime and delivered to the UK's NETS.

Equation 1:

$$\textit{Energy produced per year } (MWh):$$

$$\textit{Installed Capacity } (MW) \times \textit{ hours per year } \times \textit{Capacity Factor } (\%) \times (1 - \textit{Electrical Losses in the System Boundary } (\%))$$

18-46. For the purposes of the assessment, the capacity factor for the Proposed Offshore Development was anticipated to be 53.5%, which is the floating offshore wind assumed load factor in the DESNZ Contract for Difference (CfD) (Allocation Framework – Appendix 3 – Load Factors) Regulations for Round 6 Allocation (DESNZ, 2024b) which provides the predicted capacity factors for new build offshore wind farms (delivery years 2026-2029).

18-47. The Project would have an availability factor of 97%, meaning the potential operational hours per year is 8,456. In addition, it was advised that electrical losses would be approximately 10%.

18-48. In accordance with **Equation 1,** the total energy generated by the Project is predicted to be:

Equation 2:

$$\textit{Energy produced per year } (MWh)\text{: } 1{,}000\ MW \times 8{,}456\ hours \times 53.5\% \times (1 - 0.1) = 4{,}071{,}564\ \frac{MWh}{year}$$

$$\textit{Energy produce over the Project's lifetime: } 4{,}071{,}564\ MWh \times 35\ years = 142{,}504{,}740\ MWh$$

GHG emissions from the 'Do Nothing' scenario

18-49. GHG emissions produced from the generation of electricity by a gas-fired power plant equipped with CCS in the 'Do Nothing' scenario is presented in **Table 18-7**. This has been quantified by multiplying the proportion of anticipated electricity generated by the Project detailed in **Section 18.7.1.1**, by the estimated CO_2 emission from gas supplied electricity. This emission factor was derived from the Net Zero Teesside project, as this reflects the emissions intensity of a recently consented gas-fired power plant (20.7 tonnes CO_2 per GWh electricity) (Net Zero Teesside Power Ltd, 2021). This is a precautionary approach, which assumes a 95% carbon capture efficiency rate for all operating gas-fired power plants in the UK over the operation and maintenance phase of the Project.

18-50. It is noted that the emission factor is in units of CO_2 rather than carbon dioxide equivalent (CO_2e). However, CO_2 is likely to form the main contribution to generation of electricity from gas and the factor would be higher if other GHGs were included, which provides a conservative approach for the assessment. It should also be noted that this emission factor represents the use of gas at source and is not representative of lifecycle emissions which would include the extraction, processing and transportation of gas to a power station. Therefore, if these activities were included, emissions in the Do Nothing scenario would be higher.

Table 18-7 Do Nothing Future Baseline Scenario - GHG Emissions

Timeframe	**Anticipated energy produced by the Project (GWh)**	**GHG emissions from electricity generated from gas (tonnes CO_2)**
Per year	4,072	84,281
Lifetime of the Project (35 years)	142,505	2,949,848

18.7.2 Blue Carbon Assessment

18-51. Blue Carbon is the term for carbon captured by the world's ocean and coastal ecosystems (NOAA, n.d.). Plants, calcifying organisms, and sediments store and sequester carbon in short-term and long-term forms, with disturbances to sediment top layers having most potential to release the stored carbon. A carbon stock or store is the quantity of carbon held in a habitat at any given time, and the rate at which the carbon is stored is known as the carbon sequestration rate.

18-52. The International Union for Conservation of Nature (IUCN) defines Blue Carbon as "carbon stored in coastal and marine ecosystems" (IUCN, 2017). Similarly, the Scottish Blue Carbon Forum sets out a broad definition of Blue Carbon (Scottish Blue Carbon Forum, n.d.) as follows "*Blue Carbon is the carbon captured and stored in marine and coastal ecosystems that accumulates over long timescales through natural processes.*"

18-53. This refers to both 'autochthonous' carbon derived from biological processes such as photosynthesis and calcification, and 'allochthonous' carbon from other sources like terrigenous matter, which is deposited and stored in marine sediments.

18.7.2.1 Blue Carbon in Scotland

18-54. A report by NatureScot, documents the current evidence for Scotland's Blue Carbon habitats (Cunningham & Hunt, 2023). A similar list was also compiled by the Wildlife Trust in its document 'The United Kingdom's Blue Carbon inventory' (Burrows, et al., 2024). The key habitats that support Blue Carbon storage and sequestration in Scottish waters include:

- Vegetated Coastal habitats;
- Machair;
- Sand dunes;
- Saltmarsh;
- Nearshore habitats;
- Seagrass beds;
- Intertidal macroalgae;
- Kelp beds;
- Calcifying aggregations;
- Maerl beds;
- Sabellaria reefs;
- Cold-water coral reefs (*Lophelia pertusa*);
- Tube worm reef (Serpula vermicularis);
- Flame shell beds (*Limaria hians*);
- Horse mussel beds (*Modiolus modiolus*);
- Blue mussel beds (*Mytilus edulis*);
- Native oyster (*Ostrea edulis*);
- Brittlestar beds (*Ophiothrix fragilis*);
- Bryozoan thickets (*Flustra foliacea*); and
- Seabed sediments.

18-55. Scotland's biogenic marine habitats, such as seagrasses, salt marshes, and mangroves, are highly productive and efficient at assimilating carbon, with a high carbon assimilation rate (662 gC/m^2/yr) primarily in coastal areas (Burrows, et al., 2014) (Burrows, et al., 2017).

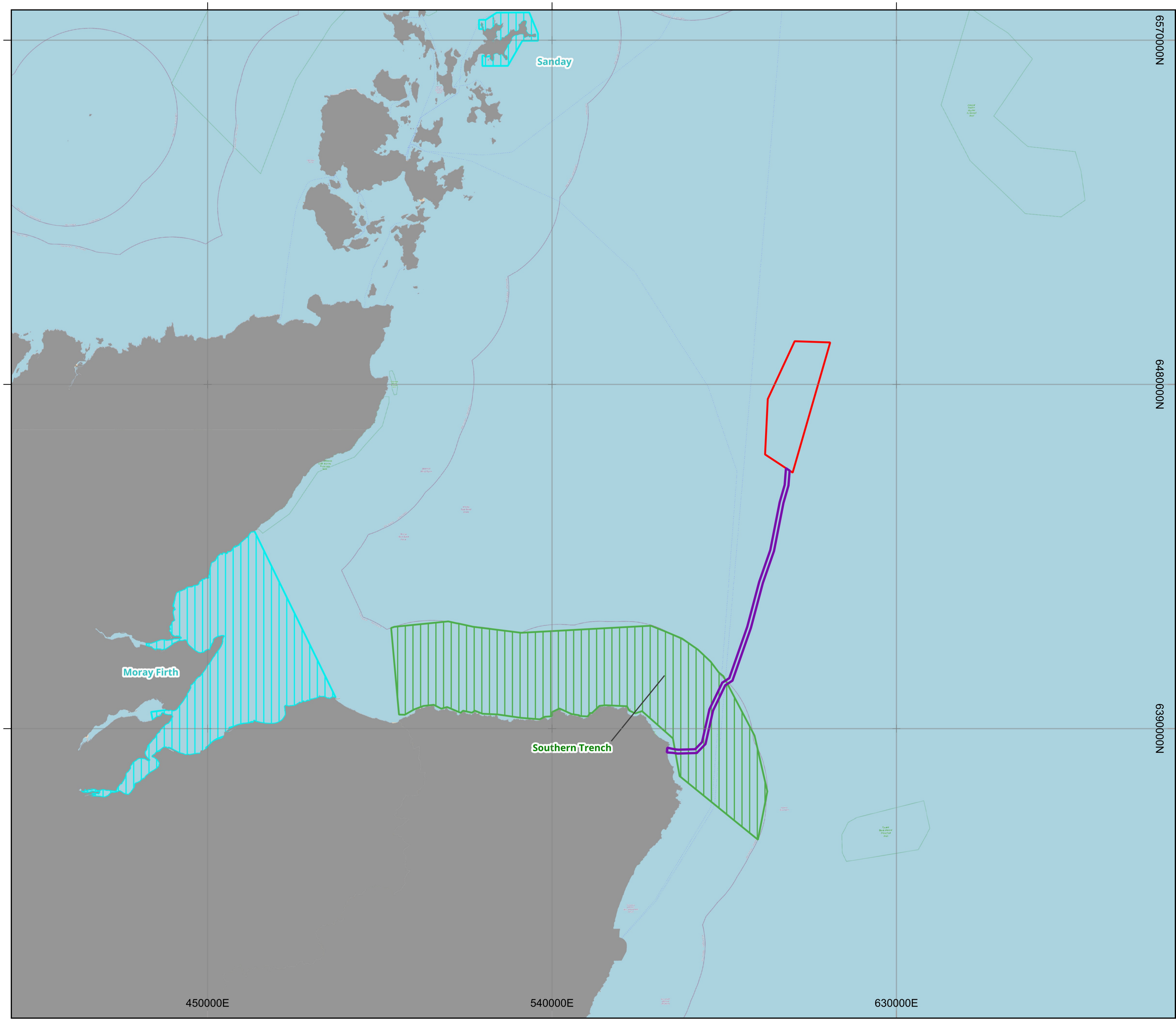
18-56. Marine sediments store carbon as organic or inorganic forms, depending on factors such as water chemistry, oxygen levels, and microbial activity. Inorganic Carbon (IC) is the predominant source in marine sediments, with Scotland's marine habitats acting as a carbon reserve. UK waters have several Blue Carbon habitats, including kelp forests, salt marshes, mudflats, and sandflats. In Scotland, the majority of Blue Carbon is stored within seabed sediments, with an estimated 7.64 mega tonnes sequestered annually in the top 10 cm of

Scotland's marine sediments (Scottish Blue Carbon Forum, n.d.). The majority of this carbon is in the form of calcium carbonate, with a lower proportion in organic form.

18-57. Scotland's coastal and offshore sediments are the primary stores of carbon in Scotland's marine environment. An estimated 18 million tonnes (Mt) of Organic Carbon (OC) and 1,738 Mt of IC are stored in the top 10 cm of sediments across Scotland's seas. The main producer of carbon entering long-term storage is phytoplankton, with coastal plants potentially contributing a further 1.8 million tonnes per year (Mt/yr). Habitat-forming species on the coast are highly productive but their contribution to the overall carbon emissions is very small due to the limited extent of each habitat (Burrows, et al., 2014).

18.7.2.2 Benthic Habitats

18-58. The ECC passes through the Southern Trench Marine Protected Area (MPA), a deep trench formed by glaciers (**Figure 18-1**). The seabed along the ECC is predominantly sand and gravel, with bedrock in the nearshore and silty sand moving further offshore. Mobile sediments have been recorded across the area. The Southern Trench MPA has been designated to protect the features listed below in **Table 18-8.**



Project:

Buchan Offshore Wind EIA

Title:

Figure 18-1: Southern Trench MPA Location

Key

- Array Area
- Export Cable Corridor (ECC)
- Marine Protected Area (MPA)
- Special Area of Conservation (SAC)

Scale @ A3:1:1,000,000

Coordinate System: WGS 84 UTM Zone 30N
Graticules: WGS84

0 10 20 30 40 km

N

Date: 09-07-25	Prepared by: JH	Checked by: PB

EIA Ref No: BUC-C-MP-NP-0197

Map Ref: Figure18-1_SouthernTrenchMPA

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Table 18-8 Southern Trench MPA Protected Features

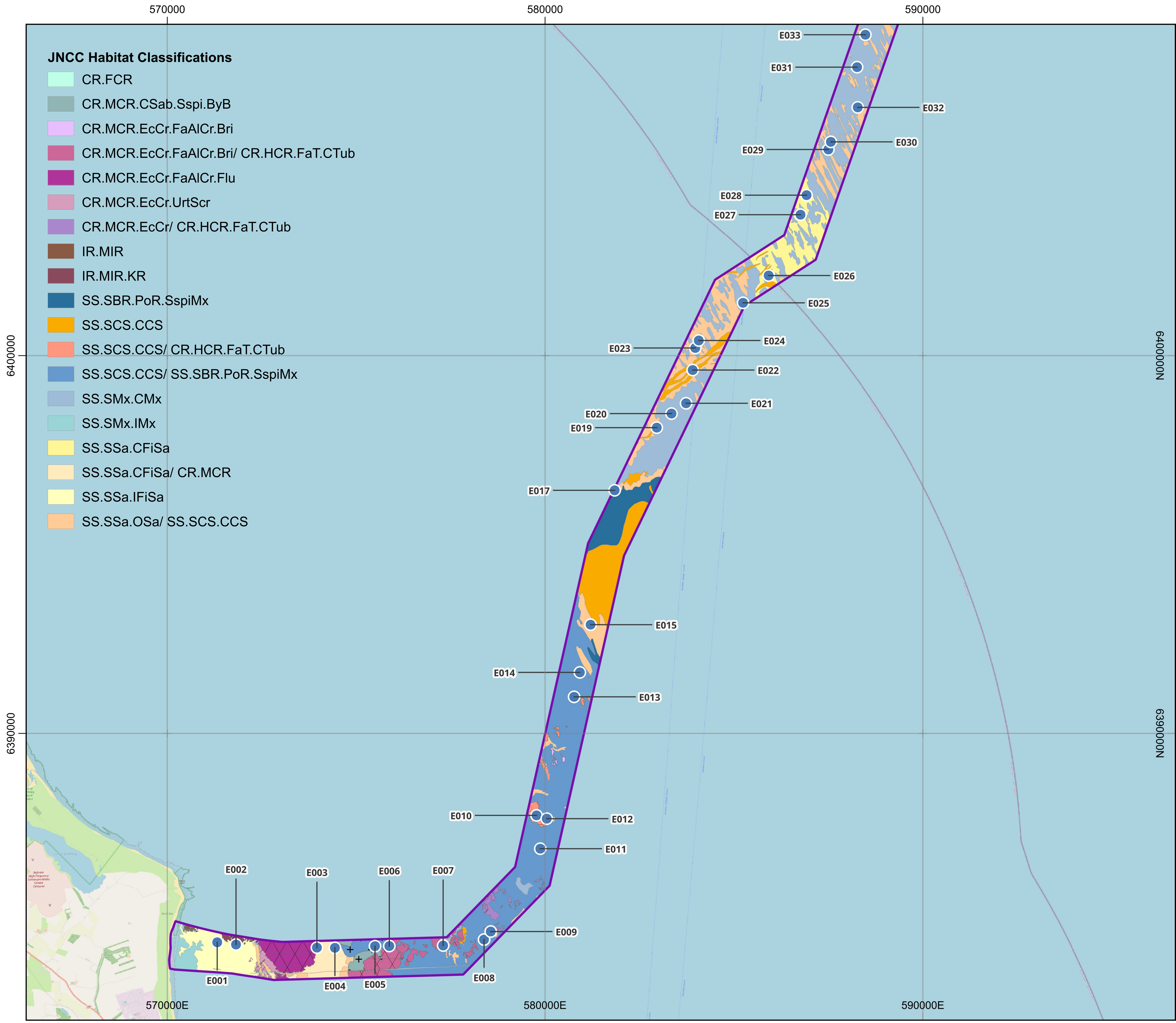
Species	Habitats	Geology
Minke whale	Burrowed mud Fronts Shelf deeps	Quaternary of Scotland: Moraines and Sub-glacial tunnel valleys Submarine Mass Movement: Slide scars

18-59. A total of 14 Joint Nature Conservation Committee (JNCC) defined habitats were determined to be present within the survey area for the **Volume 1, Chapter 7: Benthic and Intertidal Ecology** Environmental Survey Report presented in **Volume 3, Appendix 7.1 Environmental Survey Report**. This survey area encompasses the Proposed Offshore Development Site, and therefore the study area for the Blue Carbon assessment. Of these habitats, five were identified as areas that support Blue Carbon storage or sequestration, which are listed in **Table 18-9**. The extent of these habitats is displayed in **Figure 18-2, Figure 18-3, Figure 18-4** and **Figure 18-5** (also presented in **Volume 3, Appendix 7.1 Environmental Survey Report**), which highlights that all of the potential Blue Carbon habitats are within the ECC, and none were identified in the Array Area. The identified Blue Carbon habitats are all found in areas with a water depth of less than 50 m. Water depths within the Array Area range from approximately 73 m to 110 m.

18-60. In addition to this, the Environmental Survey Report, presented in **Volume 3, Appendix 7.1 Environmental Survey Report**, also identified seven sediment habitats across the Proposed Offshore Development Site, which are listed in **Table 18-10**.

Table 18-9 Identified Blue Carbon benthic habitats within the surveyed area. Source: (Ocean Infinity, 2023)

JNCC Classification	EUNIS Classification	Site ID
CR.MCR.CSab.Sspi.ByB *Sabellaria spinulosa* with a bryozoan turf and barnacles on silty turbid circalittoral rock	**MC12811** *Sabellaria spinulosa* with a bryozoan turf and barnacles on silty turbid Atlantic circalittoral rock	T006
SS.SBR.PoR.SspiMx *Sabellaria spinulosa* on stable circalittoral mixed sediment	**MC2211** *Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment	E016, E018 Note the following sites were coupled with habitat SS.SCS.CCS Circalittoral coarse sediment: E005 - E008, E011, E013, E014, T012, T013
MCR.EcCr.FaAlCr.Bri Brittlestars on faunal and algal encrusted exposed to moderately wave-exposed circalittoral rock	**MC12244** Brittlestars on faunal and algal encrusted exposed to moderately wave-exposed Atlantic circalittoral rock	T012 Note the following sites were coupled with habitat CR.HCR.FaT.CTub *Tubularia indivisa* on tide-swept circalittoral rock: T006 – T008
CR.MCR.EcCr.FaAlCr.Flu Bryozoan thickets, *Flustra foliacea* on slightly scoured silty circalittoral rock	**MC12241** *Flustra foliacea* on slightly scoured silty Atlantic circalittoral rock	T002, T004, T005
IR.MIR.KR Kelp and red seaweeds (moderate energy infralittoral rock)	**MB123** Kelp and seaweed communities on sediment-affected or disturbed Atlantic infralittoral	T001



Project:

Buchan Offshore Wind EIA

Title:

Figure 18-2: Overview of Grab Sample Sites (E001-E033)

Key

Export Cable Corridor (ECC)

Grab Sample Sites

Environmental Features

Annex I (1170) - Bedrock Reefs

Annex I (1170) - Bedrock Reefs/ Biogenic Reefs

Annex I (1170) - Bedrock Reefs/ Stony Reefs

Annex I (1170) - Stony Reefs, Low

Annex I (1170) - Stony Reefs, Low/ S. spinulosa aggregations

Scale @ A3:1:100,000

Coordinate System: WGS 84 UTM Zone 30N
Graticules: WGS84

0 1 2 3 4 km

N

Date: 09-07-25	Prepared by: JH	Checked by: PB

EIA Ref No: BUC-C-MP-NP-0198

Map Ref: Figure18-2_GrabSamplesE001-E033

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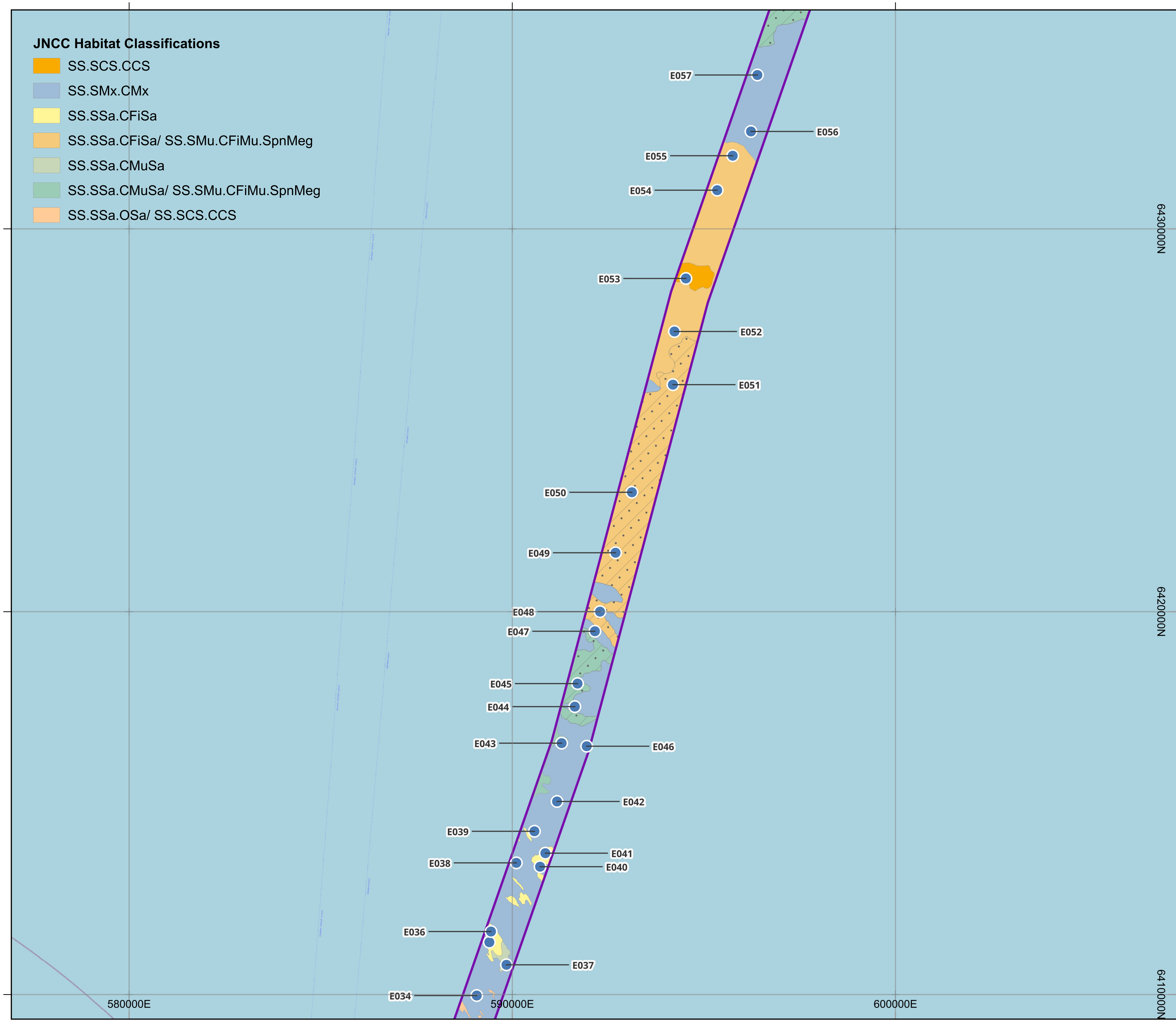

Project:

Buchan Offshore Wind EIA

Title:

Figure 18-3: Overview of Grab Sample Sites (E034-E057)

Key

Export Cable Corridor (ECC)

Grab Sample Sites

Environmental Features

OSPAR - Sea-pen and Burrowing Megafauna Communities

Scale @ A3:1:100,000

Coordinate System: WGS 84 UTM Zone 30N
Graticules: WGS84

0 1 2 3 4 km

N

Date: 09-07-25	Prepared by: JH	Checked by: PB

EIA Ref No: BUC-C-MP-NP-0199

Map Ref: Figure18-3_GrabSamplesE035-E057

BUCHAN OFFSHORE WIND

Project:

Buchan Offshore Wind EIA

Title:

Figure 18-4: Overview of Grab Sample Sites (E058 - E066, E075, E076, E085 and E089 and Classified Habitats)

Key

Array Area

Export Cable Corridor (ECC)

Grab Sample Sites

Environmental Features

OSPAR - Sea-pen and Burrowing Megafauna Communities

Scale @ A3:1:100,000

Coordinate System: WGS 84 UTM Zone 30N
Graticules: WGS84

0 1 2 3 4 km

N

Date: 09-07-25	Prepared by: JH	Checked by: PB

EIA Ref No: BUC-C-MP-NP-0200

Map Ref: Figure18-4_GrabSamplesE058

BUCHAN OFFSHORE WIND

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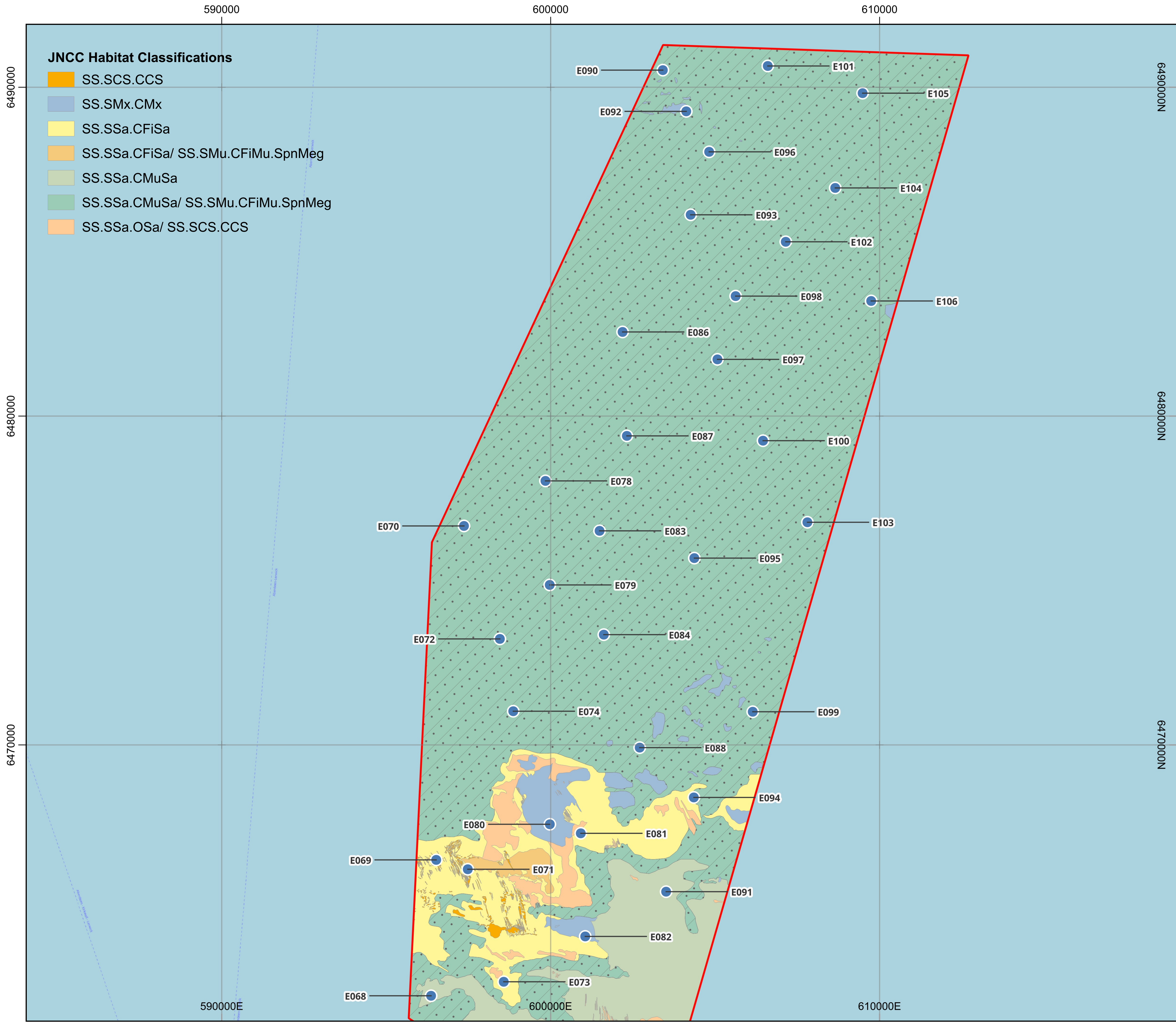

Project:

Buchan Offshore Wind EIA

Title:

Figure 18-5: Overview of Grab Sample Sites (E068 - E074, E077, E078, E079 - E084, E090 and E106 and Classified Habitats)

Key

Array Area

Grab Sample Sites

Environmental Features

OSPAR - Sea-pen and Burrowing Megafauna Communities

Scale @ A3:1:115,000

Coordinate System: WGS 84 UTM Zone 30N
Graticules: WGS84

0 1 2 3 4 km

N

Date: 09-07-25	Prepared by: JH	Checked by: PB

EIA Ref No: BUC-C-MP-NP-0201

Map Ref: Figure18-5_GrabSamplesE068

BUCHAN OFFSHORE WIND

Table 18-10 Identified Blue Carbon sediment habitats within the surveyed area. Source: (Ocean Infinity, 2023)

JNCC Classification	EUNIS Classification	Site ID
SS.SCS.CCS Circalittoral coarse sediment	**MC321** Faunal communities of Atlantic circalittoral coarse sediment	E022, E026, E053, E071 Note the following sites were coupled with habitat CR.HCR.FaT.CTub *Tubularia indivisa* on tide-swept circalittoral rock: E010, T011, T013 And SS.SBR.PoR.SspiMx *Sabellaria spinulosa* on stable circalittoral mixed sediment: E005 - E008, E011, E013, E014, T012, T013
SS.SMx.CMx Circalittoral mixed sediment	**MC421** Faunal communities of Atlantic circalittoral mixed sediment	E009, E020, E023, E025, E027, E030, E031, E033, E034, E036, E038 - E040, E042, E044, E046, E047, E056, E057, E060, 063, E076, E080, T002, T014, T016, T017
SS.SMx.IMx Infralittoral mixed sediment	**MB42** Atlantic infralittoral mixed sediment	N/A
SS.SSa.CFiSa Circalittoral fine sand	**MC521** Faunal communities of Atlantic circalittoral sand	E026, E028, E035, E041, E069, E071, E073, E081, E082 Note the following sites were coupled with habitat CR.MCR Moderate energy circalittoral rock: E003, E004 And SS.SMu.CFiMu.SpnMeg Seapens and burrowing megafauna in circalittoral fine mud: E048 - E052, E054, E055
SS.SSa.CMuSa Circalittoral muddy sand	**MC521** Faunal communities of Atlantic circalittoral sand	E037, E068, E091 Note the following sites were coupled with habitat SS.SMu.CFiMu.SpnMeg Seapens and burrowing megafauna in circalittoral fine mud: E043, E045, E058, E059, E061, E062, E064 – E067, E070, E072, E074, E075, E077 – E079, E083, E084, E086 – E088, E090, E092 – E106, T015
SS.SSa.IFiSa Infralittoral fine sand	**MB52** Atlantic infralittoral sand	E001, E002
SS.SSa.Osa Offshore circalittoral sand	**MC521** Faunal communities of Atlantic circalittoral sand	E012, E015, E017, E019, E021, E024, E029, E032, E085, E089, T003 (Note these were coupled with habitat SS.SCS.CCS Circalittoral coarse sediment)

18-62. Data for the blue carbon content of the sediments specifically listed in **Table 18-10,** which were identified in the Environmental Survey Report, presented in **Volume 3, Appendix 7.1 Environmental Survey Report** were not available for use in the Blue Carbon Assessment. Therefore, publicly available data was used to determine the potential levels of blue carbon within the study area, which is discussed further in **Section 18.7.2.3** and **Section 18.7.2.4.**

18.7.2.3 Organic and Inorganic Storage in Sediments

18-63. Smeaton *et al.,* (2021a) updated their figures on marine sedimentary carbon stocks of the United Kingdom's exclusive economic zone in 2021, which are the most up to date figures on carbon stored within Scottish marine sediments. As part of this work, a bespoke seabed sediment type map based on a modified Folk classification scheme was devised (Folk, 1954) (Kaskela, *et al.*, 2019).

18-64. Marine sediments on the ocean floor store large quantities of OC over long timescales, with an estimated 87,000 ± 43,000 Mt of OC held within the surficial sediments (Lee *et al.*, 2019). The highly heterogeneous nature of the seabed means that large differences exist in the amount of OC trapped and stored across sedimentary environments. For example, continental shelf sediments occupy 8.9% of the global seabed area, yet they hold 16% of the global OC stock (Atwood *et al.*, 2020).

18-65. These sedimentary environments play an important role in the global carbon cycle, with an increasing number of proponents suggesting that these sedimentary systems provide a natural climate solution that mitigates climate change and requires management.

18-66. The results of the spatial mapping in Smeaton *et al*., (2021a) revealed distinct differences in the national and regional sedimentary composition of the UK Exclusive Economic Zone (EEZ). Sand is the dominant sediment type within the UK EEZ, with the largest quantity found in the English sector of the North Sea. After sand, muddy sediments constitute a large proportion of the UK EEZ seabed, with approximately 75% of all muddy sediments being located within Scottish waters.

18-67. The surficial sediments of Scotland (457,926 km^2) store 382.6 ± 34.2 Mt OC. This considerable figure is largely driven by the abundant OC-rich, muddy sediments in Scottish waters. The OC held within Scotland's sediment represent approximately 64% of the total held within the UK EEZ as shown in **Table 18-11**.

Table 18-11 Organic carbon stock in Scotland's EEZ surficial sediments. Source: (Smeaton *et al.*, 2021a)

	Slope and Deep Sea	**Fjords**	**Coastal & Inshore**	**Outer Shelf**	**Scotland Total**	**Percentage of UK Stock**
Average OC stock [Mt] ± s.d.	186.41 ± 20.05	3.92 ± 0.55	41.68 ± 5.05	150.63 ± 8.56	**382.64 ± 34.21**	**64%**

18-68. The IC content in surficial sediments (i.e. those in the top 10 cm) is not related to sediment type. An estimated 2,582.3 ± 167.8 Mt IC is held within the surficial sediments (top 10 cm) of the UK EEZ (Smeaton *et al.*, 2021a), of which 1,294 ± 161 Mt falls within Scottish waters (Smeaton *et al.*, 2020).

18.7.2.4 Sediment Stocks in the Proposed Offshore Development Site

18-69. The sedimentary data available from **Volume 3, Appendix 7.1 Environmental Survey Report** highlights that the sediments of the Proposed Offshore Development Site fall within two EUNIS classification groups: 'A4 - Circalittoral rock and other hard substrata' and 'A5 - Sublittoral sediment'. The areas of each EUNIS marine habitat and sediment type are summarised in **Table 18-12** and **Table 18-13**. The predominant sediment type within the Proposed Offshore Development Site was sand, followed by muddy sand.

18-70. For continental shelf sediments, those highest in sand or gravel content generally have the lowest OC content, meanwhile those with higher amounts of mud, have the highest. For example, gravelly sand has an OC concentration of 0.32%, whereas mud has an OC concentration of 1.10%; almost 3.5 times higher (Smeaton *et al.*, 2021).

Table 18-12 EUNIS Sediment Marine Habitat type and area within the Proposed Offshore Development Site. Source: (Volume 3, Appendix 7.1 Environmental Survey Report)

EUNIS Marine Habitat	Area (km^2)	Percentage cover
A5.23 or A5.24: Infralittoral fine sand or Infralittoral muddy sand	0.12	0.03%
A5.25 or A5.26: Circalittoral fine sand or Circalittoral muddy sand	3.7	0.89%
A4.1: Atlantic and Mediterranean high energy circalittoral rock	1.2	0.28%
A4.2: Atlantic and Mediterranean moderate energy circalittoral rock	0.51	0.12%
A5.27: Deep circalittoral sand	308.4	74.17%
A5.15: Deep circalittoral coarse sediment	32.1	7.72%
A4.27: Faunal communities on deep moderate energy circalittoral rock	0.67	0.16%
A5.37: Deep circalittoral mud	69.1	16.61%
Total	**415.8**	

Table 18-13 Substrate type and area within the Proposed Offshore Development Site. Source: (Volume 3, Appendix 7.1 Environmental Survey Report)

Substrate	Area (km^2)	Percentage cover
Sand	312.2	75.09%
Infralittoral seabed	0.03	0.01%
Rock or other hard substrata	2.4	0.57%
Coarse substrate	32.1	7.72%
Muddy sand	69.1	16.61%
Total	**415.8**	

18.7.3 CCR Assessment

18-71. The purpose of the CCR Assessment is to evaluate the resilience and vulnerability the Project to the anticipated effects of climate change over the construction, operation, and decommissioning phases.

18-72. The assessment determines the baseline environment, and analyses how climate variables may change throughout the life-cycle of the Project, and the associated increase in risk from climate hazards. The vulnerability of various components of the Project are assessed for these hazards, for example WTGs affected by extreme weather conditions such as high winds and storms which could increase the frequency of operational disruptions. Any likely significant effects arising are addressed with appropriate mitigation and monitoring as required.

18.7.3.1 Present-day Baseline - General

18-73. The present-day baseline is representative of the existing climatic conditions. This baseline is used to provide context to the changes in climate and conditions and their impacts on the Proposed Offshore Development throughout its operation and maintenance, and decommissioning phases.

18-74. The present-day baseline is considered to provide a suitable representation of the expected climatic conditions during the construction phase of the Proposed Offshore Development, which is expected to be completed to enable full operation by 2035. The degree of climatic change from now until the end of construction, distinct from standard weather fluctuations, is unlikely to result in noticeably different conditions. This is especially true when compared to the operational timeframe where changes in climate-related hazards are more likely.

18-75. Annual mean temperatures for the UK for 2009 to 2018 were 0.2°C warmer than the 1981-2000 average, and 0.9°C warmer than the 1961-1990 average. All of the top ten warmest years for the UK, in the series from 1884, have occurred since 2002. All areas of Scotland experienced an increase in the annual average daily mean temperature between 1961 and 2006, with the increase being slightly greater in the east of the country. Average temperatures in Scotland and Northern Ireland have risen by approximately 0.8ºC since 1980.

18-76. In addition, the period from 2009 to 2018 was on average 1% wetter than 1981-2000, and 5% wetter than 1961-1990 for the UK overall (Met Office, 2022a).

18-77. The Proposed Offshore Development Site is located offshore of the northeast coast of the Grampian region, in Aberdeenshire, Scotland. The current climate for the Proposed Offshore Development Site is described in the report 'Met Office Eastern Scotland: Climate' (Met Office, 2016). This report provides a regional climate summary with a focus on the 30-year averaging period of 1981- 2010. Scotland's Marine Assessment 2020 (Scottish Government, 2020b) also provides relevant information about Scotland's marine climate. The key climate variables for eastern Scotland are summarised below.

18.7.3.2 Present-day Baseline - Temperature

18-78. The mean annual temperature for the east of Scotland varies from 9°C close to the Firth of Forth, to less than 6°C over the high ground of the Grampian mountains. This can be compared with the mean annual temperature for the UK, which varies from 6°C in the north and east of Scotland to over 11 °C in the south-west of England and the Channel Islands. Within the eastern Scotland region, there are significant variations in temperature due to the combined effects of proximity to the coast, topography and, to a lesser extent, urban development.

18-79. January and February are the coldest months in eastern Scotland, with mean daily minimum temperatures of about 2°C on the north east coast of the Grampian region. Extreme minimum temperatures usually occur in January or February, with temperatures of below -

20°C recorded in the region. Conversely, temperatures can occasionally reach 15°C in winter due to a southerly airstream that warms after crossing upland. Maximum temperatures occur in July and August, with mean daily maximum temperatures of less than 17°C along the Grampian coast. Extreme maximum temperatures, associated with heatwaves, can exceed 30°C in eastern Scotland.

18-80. Eastern Scotland experiences air frost for between 40 and 90 days per year, and ground frost for less than 90 to over 150 days per year. Frost days occur more frequently on higher ground and in deep valleys within the Grampian mountains. The frost-free season in eastern Scotland can be as little as three months.

18.7.3.3 Present-day Baseline - Precipitation

18-81. Rainfall over Scotland is high compared to the UK as a whole. Average total annual rainfall varies from 700 mm to 1,500 mm across eastern Scotland, compared to annual totals of around 500 mm in the driest parts of eastern England, and over 4,000 mm in the western Scottish Highlands. Rainfall is typically well distributed throughout the year, although the wettest months tend to be in autumn and early winter, with late winter and spring usually the driest part of the year. In winter (December to February), there are about 30 wet days on average along the East Lothian and Fife coasts, and over 55 wet days in the Grampian mountains. In summer (June to August) the East Lothian and Fife coasts have an average of around 27 wet days, which increases to over 40 days in the Grampian mountains. Periods of prolonged rainfall can lead to widespread flooding, especially in winter and early spring when soils are usually near saturation and snowmelt can be a contributing factor.

18-82. Snowfall is closely linked to with temperature. Over most of eastern Scotland, snowfall normally occurs between November and April, with upland areas often having brief falls in October and May. Snow rarely lies at lower levels between May and October. On average, snow falls on about 20 days per winter along the north eastern coast, compared to more than 80 days over the Grampian mountains. The number of days with snow lying has a similar distribution.

18.7.3.4 Present-day Baseline – Wind and Fog

18-83. Eastern Scotland is one of the windier parts of the UK, as it is relatively close to the track of Atlantic depressions. The strongest winds are associated with the passage of deep areas of low pressure close to or across the UK. The frequency and strength of these depressions is greatest in the winter, when mean wind speeds and gusts are highest. Exposed coasts and hills experience stronger wind speeds and more days of gale. A gale is defined by the Beaufort Wind Scale as a strong and sustained wind that ranges between 63 and 88 kilometres per hour. The Grampian mountains have over 20 days of gale in an average year.

18-84. The prevailing wind direction in the north-east of Scotland is generally from the south-west, similar to the rest of Scotland and the UK. However, there are seasonal variations, with north-easterly winds more common in spring. The wind direction is influenced by the topography, with the Grampian mountains providing shelter to the north-east coast, which experiences fewer south-westerly winds than elsewhere in the region. As the Proposed Offshore Development Site is located approximately 75 km offshore of the Aberdeenshire coast, it is more exposed to wind than the Grampian coast.

18-85. Extreme gales can occur in eastern Scotland, causing property damage and disruption to travel and power supplies. A noteworthy example is 13 February 1989, when the low-level wind gust speed record of 123 knots was set at Kinnaird's Head lighthouse near Fraserburgh. The corresponding hourly mean speed was 68 knots.

18-86. The north-east coast of Scotland experiences sea-fog (haar) in late spring and summer. There is no clear evidence of an increase in sea-fog over the past decade. Sea fog can affect transportation, shipping and oil platforms, with reduced visibility disrupting flights, grounding helicopters, and causing delays in maritime operations.

18.7.3.5 Present-day Baseline – Sea Temperatures

18-87. The northern North Sea is strongly influenced by Atlantic inflow and has the deep Norwegian trench in the east of the ecoregion. Water depths range from 0-500 m. The majority of the area is stratified in summer, with the surface waters being warmed by the sun whilst the deeper waters remain cooler and denser. This stratification affects ecological processes such as nutrient mixing and distribution of marine life. The area is also subject to dynamic environmental conditions, including variations in sea surface temperatures and frequent storms.

18-88. Average sea temperatures around Scotland reflect the influence of heat transported from oceanic waters. Sea temperatures off the coast of north-east Scotland vary from 5-7°C in winter (December to February) and 12-14°C in summer. Peak sea temperatures lag behind peak air temperatures by about a month, with the highest sea temperatures occurring in late August. The average winter sea surface temperature in the north-east of Scotland is almost 1.5°C lower than the average winter temperature for the west of Scotland.

18.7.3.6 Present-day Baseline – Climate Data

18-89. Existing climate data for the period 1991 to 2020 has been obtained from the Fraserburgh (Aberdeenshire) meteorological recording station, which is the closest recording station to the Proposed Offshore Development Site. The Met Office UK Climate Averages (Met Office, 2022b) are only available for onshore meteorological sites. Climate data for Fraserburgh, East Scotland, Scotland and the UK are provided in **Table 18-14**.

Table 18-14: Existing Local, Regional and National Climate for the 1991 to 2020 Period (Met Office, 2022b)

Climate variable	Units	Annual average			
		Fraserburgh	East Scotland	Scotland	UK
Maximum temperature (12-month average)	°C	11.7	11.1	11.1	12.8
Minimum temperature (12-month average)	°C	6.3	4.0	4.4	5.5
Days of air frost	Days	No data	81.9	71.7	53.4
Rainfall	mm	759.8	1187.8	1572.7	1162.7
Days of rainfall ≥ 1 mm	Days	No data	164.2	191.3	159.1
Mean wind speed at 10 m	Knots	12.6	10.2	10.7	9.3

The climate data presented **Table 18-14** reflects the location of the Proposed Offshore Development Site and can be summarised as follows;

- coastal regions can be affected by sea breezes which result in lower maximum temperatures than further inland from late spring through the summer and milder temperatures in winter. Annual average maximum and minimum temperatures are both higher than the east of Scotland and Scotland averages;
- the meteorological station closest to the Proposed Offshore Development Site experiences less rainfall on average than the East of Scotland, Scotland and the UK. This is due to the predominant weather patterns in the UK whereby wetter conditions are typically experienced in the west due to the influence of south-west prevailing winds from the Atlantic Ocean. Fraserburgh is sheltered from the south-west winds by the Grampian mountains; and
- the mean wind speed (at 10 m) at Fraserburgh is more than 20% higher than the regional, Scotland, and UK averages.

18.7.3.7 Predicted Future Baseline – General

18-90. The Met Office's UKCP18 database (Met Office, 2022a) provides probabilistic climate change projections for the onshore area of the UK at a spatial resolution of 25 km grid squares from the time period of 1961 to 2100. Probabilistic projections are based on possible changes in future climate based on an assessment of climate model uncertainties, and are most suitable for characterising future extremes in risk assessments as they provide the broadest range of climate outcomes.

18-91. The most relevant UKCP18 grid cells were used to download the relevant climate data to represent the spatial scope of the future baseline of the Proposed Offshore Development. The majority of UKCP18 probabilistic projections are onshore-based, so the closest grid cell to the Proposed Offshore Development Site has been selected, as shown in **Figure 18-6**. The grid square used for the UKCP18 marine projections is shown in **Figure 18-7.**

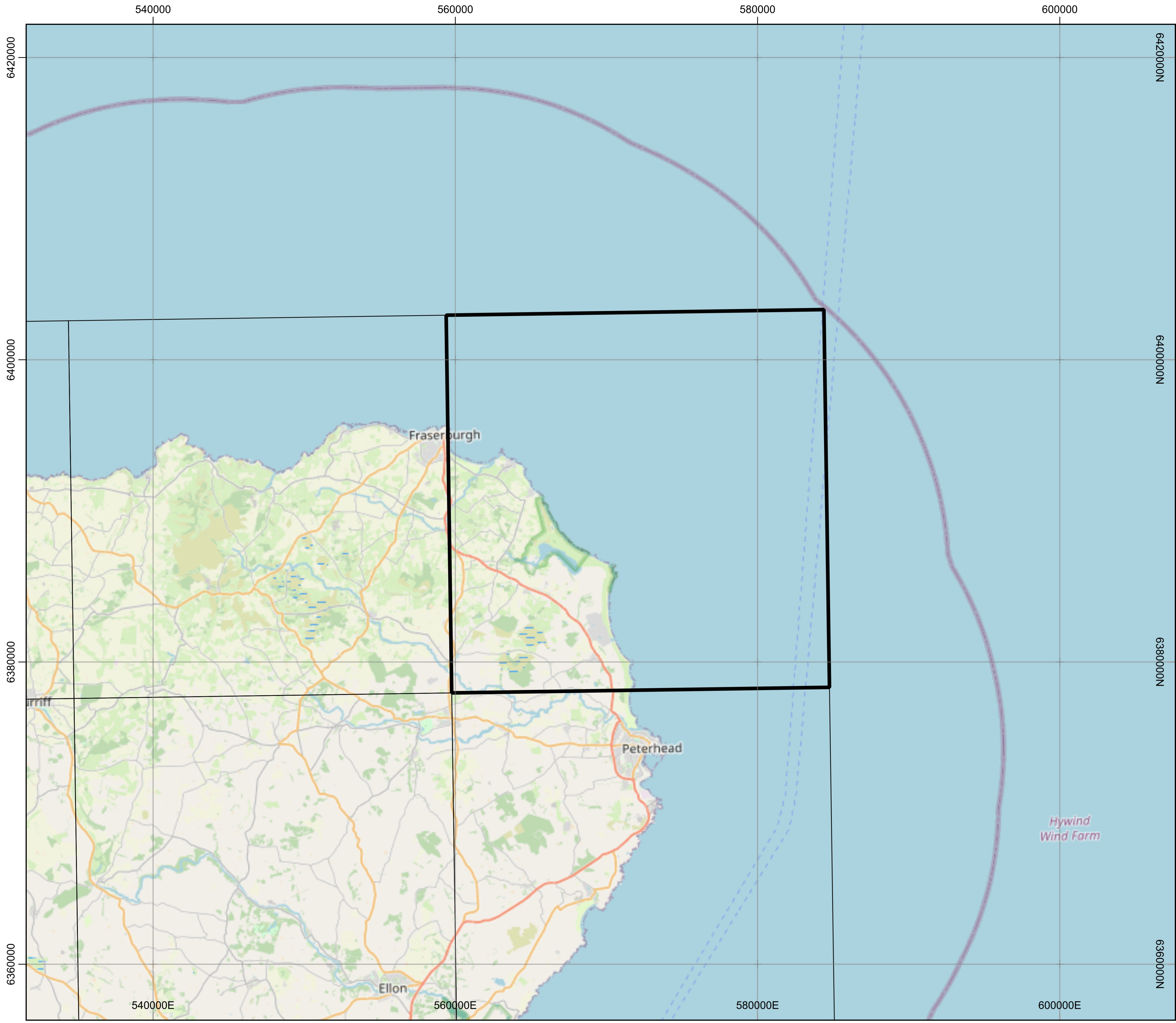

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Figure 18-6: Grid Cell used for UKCP18 Land Data Extraction

Key

- UKCP18 Land Data Grid Relevant Blocks
- UKCP18 Land Data Grid

Scale @ A3:1:250,000

Coordinate System: British National Grid
Graticules: British National Grid

0 3 6 9 12 km

N

Date: 09-07-25	Prepared by: JH	Checked by: PB

EIA Ref No: BUC-C-MP-NP-0202

Map Ref: Figure18-6_UKCP18LandData

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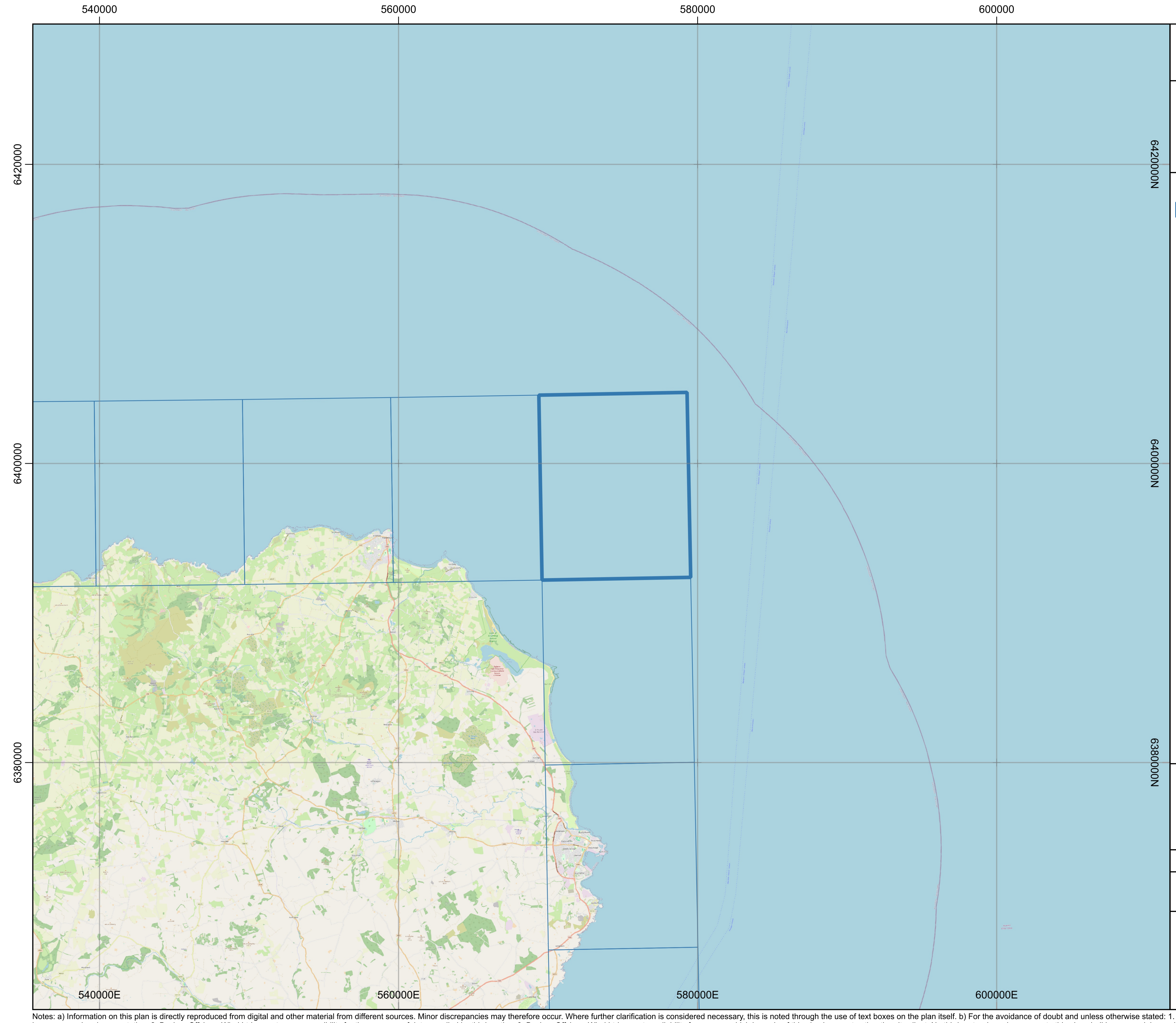

Project:

Buchan Offshore Wind EIA

Title:

Figure 18-7: Grid Cell used for UKCP18 Marine Data Extraction

Key

- UKCP18 Marine Data Grid Relevant Blocks
- UKCP18 Marine Data Grid

Scale @ A3:1:250,000

Coordinate System: WGS 84 UTM Zone 30N
Graticules: WGS84

0 3 6 9 12 km

N

Date: 09-07-25	Prepared by: JH	Checked by: PB

EIA Ref No: BUC-C-MP-NP-0203

Map Ref: Figure18-7_UKCP18MarineData

BUCHAN OFFSHORE WIND

18-92. The potential effects of climate change are projected to increase over time. Onshore, the key trend is towards warmer, wetter winters and hotter, drier summers (Met Office, 2019). Offshore warming seas, reduced oxygen, ocean acidification and sea-level rise are described as key risks for the future environment in UK seas (MCCIP, 2020).

18-93. UKCP18 database provides probabilistic projections for 20-year time periods relative to the 1981 to 2000 baseline. The climate projections have been obtained for the periods 2030-2049, 2050-2069 and 2060-2079 in line with the anticipated construction, operation and maintenance, and decommissioning phases of the Proposed Offshore Development.

18-94. The UKCP database uses Representative Concentration Pathways (RCPs) which align with the emissions scenarios used in the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment report (AR5) (IPCC, 2014). The likelihood of individual RCPs occurring is dependent on current and future GHG emissions and the implementation of mitigation strategies. The RCP scenarios used for the CCR assessment are defined in **Table 18-15**. For each of these RCPs, where relevant and available, three probabilities will be considered in the CCR assessment: 10% (unlikely), 50% (central estimate of projections) and 90% (projections unlikely to be less than).

Table 18-15: Summary of the RCP Emission Scenarios considered in this CCR assessment

RCP	Scenario Description	Increase in global mean surface temperature (°C) by 2081-2100	Parameters
4.5	Intermediate scenario 1	2.4 (range 1.7 – 3.2)	GHG emissions peak around 2040 and then start to decline
8.5	Very high GHG emissions scenario (worst case)	4.3 (range 3.2 -5.4)	Increasing global GHG emissions throughout the 21st century

18-95. The predicted future baseline is provided as the anomaly (change) compared to the baseline conditions for the period of 1981-2010 (Met Office, 2022a).

18-96. Future climate projections are modelled predictions which are strongly dependent on future global GHG emissions, and uncertainties associated with these are detailed in **Table 18-15**. In some cases, projections to the year 2100 (or later) are presented, as this is the only data available for some climate variables.

18-97. Where information is not directly available from UKCP18, climate risks have been assessed using a combination of variables and/or other sources of information, or from technical guidance provided alongside UKCP18.

18-98. The majority of the UKCP18 probabilistic projections are land-based and therefore do not provide direct coverage of the Proposed Offshore Development Site. The land-based projection data for the grid cells closest to the Proposed Offshore Development shows limited spatial variation, so is considered to provide an appropriate representation of the temperature anomaly, precipitation anomaly and wind speed anomaly for the Study Area of the CCR assessment. This data has been extracted for the onshore grid-cells closest to the Proposed Offshore Development Site,, and is considered to be representative of the Study Area.

18.7.3.8 Meteorological Projections –Temperature

18-99. In the UK, winters are projected to become warmer and wetter, with summers becoming hotter and drier over the 21st century, although some dry winters and wet summers will still occur.

18-100. By the end of this century, all areas of the UK are projected to be warmer, with more warming expected in the summer than in the winter (Met Office, 2022b). During the summer, probabilistic projections show a north/south contrast, with greater increases in maximum summer temperatures over the southern UK compared to northern Scotland (Met Office, 2022a). Under a high emissions scenario, by 2070 the frequency of hot spells (i.e. maximum daytime temperatures exceeding 30°C for two or more consecutive days) increases. Currently, these are largely confined to south-east UK (Met Office, 2022b). Under an RCP8.5 scenario, where global GHG emissions continue to increase throughout the 21st century, it is projected that annual temperatures by 2070 could increase by between 0.7°C and 4.2°C in the winter and 0.9°C and 5.4°C in the summer, compared to a 1981 to 2000 mean (Lowe *et al.* 2018).

18.7.3.9 Meteorological Projections – Precipitation

18-101. By 2070 under RCP8.5, the probabilistic projections show that UK average changes in rainfall range from a decrease of -1% to an increase of +35% in winter and from a decrease of -47% to an increase of +2% in summer, when compared against the 1981-2000 baseline average. Overall, precipitation levels are likely to continue to increase in the winter but decrease during the summer (Lowe *et al.*, 2018). Future climate change is expected to bring about a change in the seasonality of extremes, such as increases in heavy hourly rainfall intensity in the autumn, and significant increases in hourly precipitation extremes (Met Office, 2022a).

18-102. Global projections over the UK indicate that the second half of the 21st century will experience an increase in near surface wind speed during the winter season. This is accompanied by an increase in the frequency of winter storms (Met Office, 2022b). The most recent climate projections for the UK suggest there is still uncertainty regarding the relationship between intensity and frequency of storms and future climate change (Met Office, 2022b).

18-103. Changes in the annual average temperature and precipitation rate anomalies compared to the 1981-2000 baseline are presented for the Study Area in **Table 18-16** for the RCP4.5 (intermediate) scenario and in **Table 18-17** for the RCP8.5 (very high emission) scenario (Met Office, 2022a). These scenarios are considered the most likely to occur over the lifespan of the Proposed Offshore Development and present a range of outcomes in terms of climate projection data.

18.7.3.10 Meteorological Projections – Wind

18-104. Changes in temperature and rainfall are modelled with a high confidence, other climate parameters considered in this assessment such as wind speed have more uncertainty.

18-105. **Table 18-16** and **Table 18-17** show that under both RCP4.5 and RCP8.5, annual, summer and winter temperatures in the vicinity of the Proposed Offshore Development Site are likely to increase in the operation and maintenance (2030-2069) and decommissioning phases (2060-2079). It should be noted that the date ranges are UKCP 20-year time periods and not the duration of each phase of the Proposed Offshore Development. For the operation and maintenance phase of the Proposed Offshore Development (2040s to 2060s) under the RCP8.5 scenario, the annual mean temperature is projected to increase by between 0.7 and 2.6°C (10th and 90th percentile respectively). The worst case projected annual temperature increase under the RCP8.5 scenario (90th percentile) for the decommissioning phase of the Proposed Offshore Development (2060-2079) is 3.1°C.

18-106. Under the RCP8.5 scenario set out in **Table 18-15**, the annual mean precipitation rate is more variable. For the operation and maintenance phase (2040s to 2060s), the mean annual precipitation rate is projected to change by between -3.9 and +15.6% (10th and 90th percentile respectively).

Table 18-16: Temperature and Precipitation projections considered for the Study Area under RCP4.5 relative to the 1981 to 2000 baseline (Met Office, 2022a)

Variable	Season	Unit	2030-2049			2050-2069			2060-2079		
			Percentile			Percentile			Percentile		
			10th	50th	90th	10th	50th	90th	10th	50th	90th
Air temperature anomaly	Mean annual	°C	0.20	0.79	1.43	0.37	1.09	1.89	0.41	1.24	2.14
	Mean summer	°C	-0.02	0.80	1.64	0.17	1.22	2.32	0.30	1.47	2.70
	Maximum summer	°C	-0.32	0.71	1.73	-0.06	1.20	2.48	0.11	1.47	2.92
	Minimum summer	°C	0.24	0.94	1.66	0.41	1.33	2.27	0.51	1.52	2.60
	Mean winter	°C	-0.11	0.80	1.70	0.04	1.06	2.13	-0.03	1.11	2.30
	Maximum winter	°C	-0.07	0.76	1.60	0.07	1.01	2.03	0.01	1.07	2.17
	Minimum winter	°C	-0.16	0.85	1.87	-0.05	1.10	2.34	-0.07	1.17	2.55
Precipitation rate anomaly	Annual	%	-0.6	5.2	11.3	-3.6	4.3	13.2	-4.6	3.7	13.1
	Summer	%	-13.7	-0.2	13.3	-21.2	-5.1	11.5	-23.8	-7.5	8.6
	Winter	%	-3.2	13.2	31.5	-1.9	15.9	37.1	-4.1	15.1	38.7

Table 18-17: Temperature and Precipitation projections considered for the Study Area under RCP8.5 relative to the 1981 to 2000 baseline (Met Office, 2022a)

Variable	Season	Unit	2030-2049			2050-2069			2060-2079		
			Percentile			Percentile			Percentile		
			10th	50th	90th	10th	50th	90th	10th	50th	90th
Air temperature anomaly	Mean annual	°C	0.32	1.01	1.69	0.65	1.61	2.56	0.81	1.96	3.11
	Mean summer	°C	0.12	1.04	1.96	0.51	1.80	3.14	0.75	2.28	3.90
	Maximum summer	°C	-0.18	0.95	2.05	0.21	1.79	3.36	0.44	2.31	4.18
	Minimum summer	°C	0.40	1.18	1.96	0.80	1.92	3.08	1.03	2.38	3.76
	Mean winter	°C	0.00	0.94	1.94	0.22	1.47	2.78	0.21	1.68	3.24
	Maximum winter	°C	0.02	0.90	1.87	0.23	1.41	2.68	0.24	1.61	3.13
	Minimum winter	°C	-0.07	1.01	2.15	0.12	1.53	3.06	0.12	1.53	3.06
Precipitation rate anomaly	Annual	%	-0.6	5.6	12.4	-3.6	4.3	13.2	-4.6	3.7	13.1
	Summer	%	-16.4	-1.8	13.4	-21.2	-5.1	11.5	-23.8	-7.5	8.6
	Winter	%	-2.3	15.1	35.4	-1.9	15.9	37.1	-4.1	15.1	38.7

18.7.3.11 Meteorological Projections – Sea Temperature, Sea Level Rise, Storm Surge, Coastal Erosion)

18-107. Climate change is expected to affect sea surface and near-bottom temperatures, which in addition to a decline in sea ice formation, melting ice sheets and glaciers, contribute to global sea level rise due to thermal expansion of seawater (Fox-Kemper *et al.*, 2021). Over the last 40 years, average sea surface temperature around the UK has shown a significant warming trend of around 0.3°C per decade, with marked local and regional variations, as shown by **Figure 18-8**. From the mid-1980s, sea temperatures have generally been higher in the northern North Sea than the long-term average. The region has also experienced a significant increase in autumn bottom-temperatures (the warmest season) between 1993-2021 (Cornes *et al.*, 2023). The sea surface temperature in the north-east of Scotland increased by an average of 0.4-0.5°C per decade between 1985 and 2009. No significant trend has been observed between 2008 and 2017.

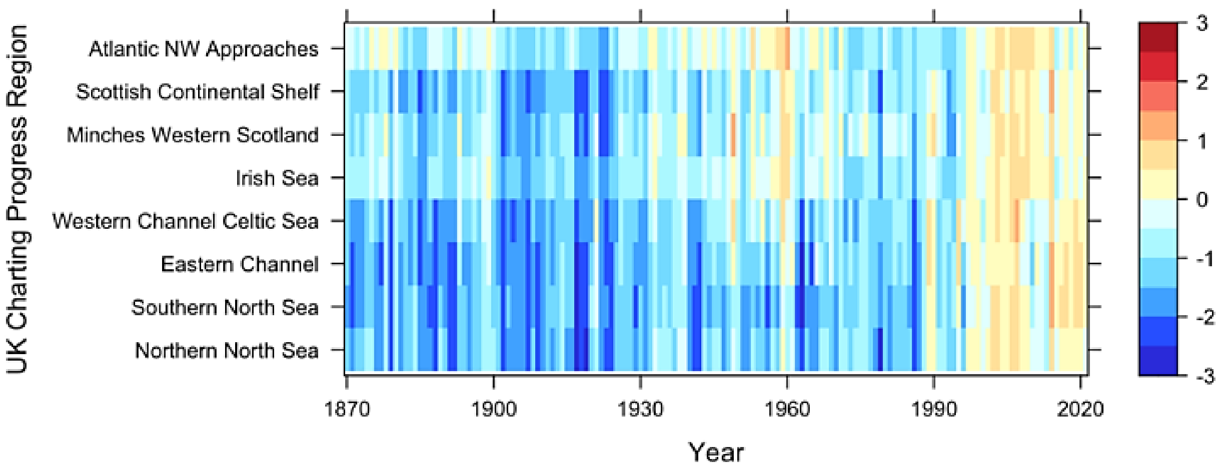

Figure 18-8 Anomaly plot of sea surface temperature (°C) for 1870-2020, relative to temperatures for the period 1991-2020 (Tinker et al., 2023)

18-108. Marine heat waves are periods during which sea surface temperatures are abnormally high compared to the typical temperatures for that region and time of year. They can vary in duration, lasting for several days or weeks, and potentially for several months. This can have significant adverse effects on the marine ecosystem. Whilst marine heat waves typically occur in spring and summer in the northern hemisphere, they can occur at any time of year. Marine cold waves represent the other end of the extreme of sea temperature conditions.

18-109. A comparison of observations, recorded between 1982 to 1998, and 2000 to 2016, indicate the marine heat waves have increased in frequency by an average of 3.8 events per year around the British Isles. Larger increases occurred to the north of the British Isles, where an increase of up to six additional events are experienced on average in the 2000 to 2016 period compared to 1982 to 1998 (Cornes *et al.*, 2023).

18-110. UKCP18 does not provide information on changes to coastal water properties, such as sea surface temperature and acidification (Met Office, 2018d).

18-111. Global sea levels have risen over the 20th century and are projected to continue rising over the coming centuries. The IPCC and the UKCP reports estimate sea level rise within the North Sea to be c. 0.5 m within the next 100 years (Palmer *et al.* 2018). It is estimated that current regional rates of sea level rise around the UK are between 1 mm to 2 mm per annum. Rates in Scotland are less than in the south of the UK because vertical onshore movement (glacial isostatic adjustment since the last ice age) is taken into consideration (Horsburgh *et al.*, 2020). Under all emission pathway scenarios, sea levels around the UK will continue to rise until 2100, and sea levels are projected to continue rising beyond 2100 even with large reductions in GHG emissions over the 21st century (Met Office, 2022a).

18-112. The UKCP climate marine projection data are most applicable to onshore and coastal areas. Average sea level rise data from the nearest coastal grid square to the Proposed Offshore Development (57.72N, -1.75E), which covers where the export cable corridor reaches the Landfall Area, were obtained from 2007 to 2100 for RCP4.5 and RCP8.5 scenarios, as displayed in **Figure 18-9** and **Figure 18-10**.

18-113. As shown in **Figure 18-9** and **Figure 18-10**, it is projected that the average sea level in the coastal area of the Proposed Offshore Development would increase over its different phases for both RCP4.5 and RCP8.5.

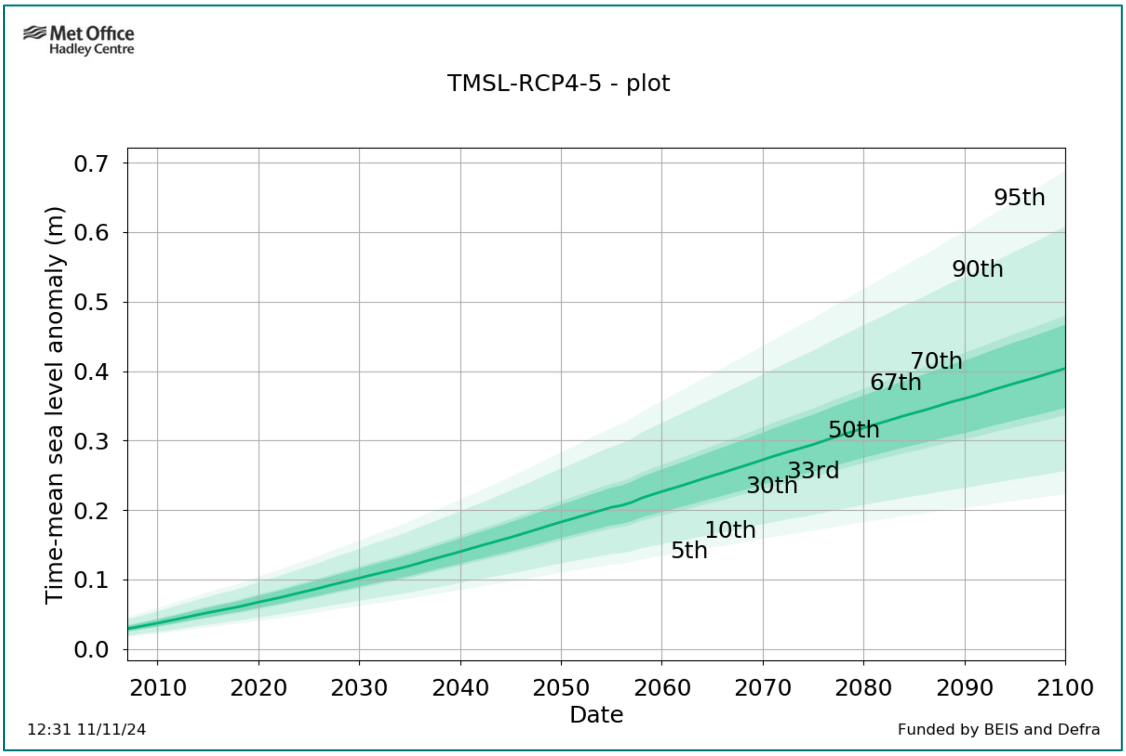

Figure 18-9 Time mean sea level anomaly (m) for baseline 1981-2000, scenario RCP4.5, 5th-95th percentiles (Met Office, 2022a)

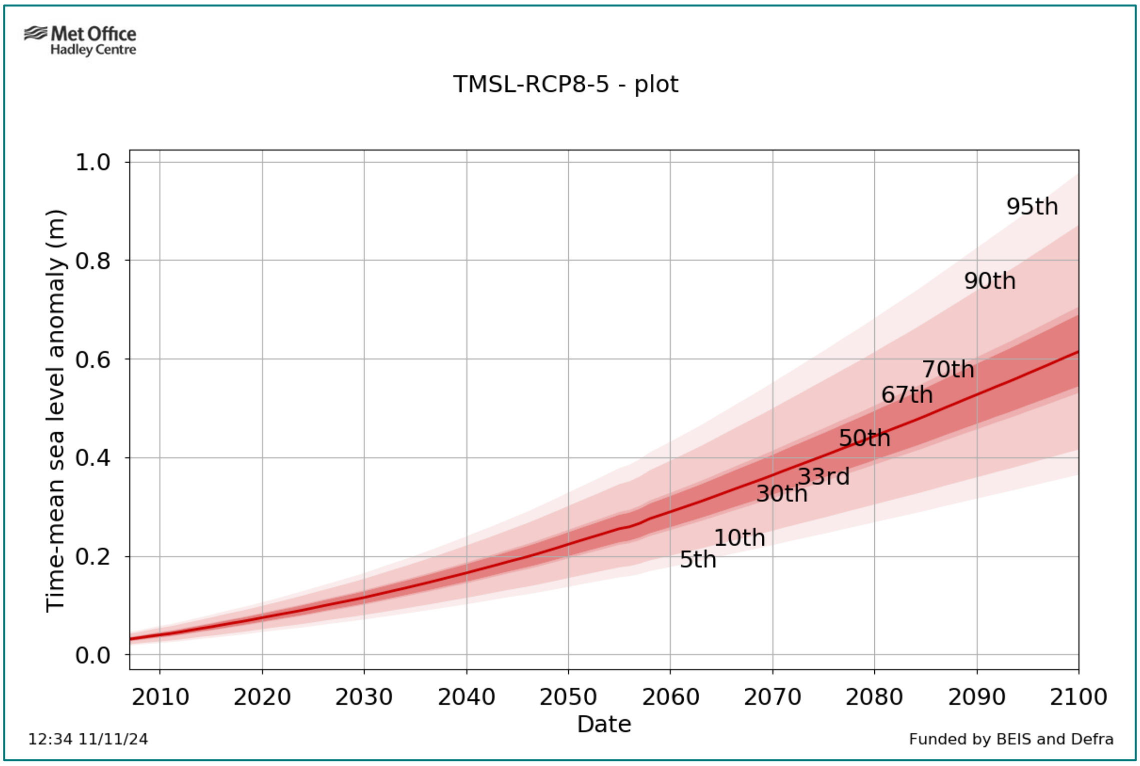

Figure 18-10 Time mean sea level anomaly (m) for baseline 1981-2000, scenario RCP8.5, 5th-95th percentiles (Met Office, 2022a)

18-114. The average sea level rise for the RCP4.5 and RCP8.5 scenarios are outlined below:

- under RCP4.5 (Met Office, 2022a):
  - by 2030 (construction phase) - average sea level rise: 0.07 to 0.14 m (10th to 90th percentile);
  - by the 2060s (operation and maintenance phase) - average sea level rise: 0.15 to 0.33 m (10th to 90th percentile); and
  - by the 2070s (decommissioning phase) - average sea level rise: 0.18 to 0.39 m (10th to 90th percentile).
- under RCP8.5 (Met Office, 2022a):
  - by 2030 (construction phase) - average sea level rise: 0.08 to 0.15 m (10th to 90th percentile);
  - by the 2060s (operation and maintenance phase)- average sea level rise: 0.20 to 0.39 m (10th to 90th percentile); and
  - by the 2070s (decommissioning phase) - average sea level rise: 0.25 to 0.50 m (10th to 90th percentile).

18-115. It is predicted that future extreme sea levels will be driven by changes in mean sea level, and not by the storm surge component or changes to tides. Future changes in storm surges have been predicted to be indistinguishable from background variation, although extreme surge level event frequency is likely to increase (IPCC, 2021).

18-116. Models and observations suggest that there has been an increase in the frequency of severe storms and in significant wave heights in UK waters since the 1950s (MCCIP, 2020). Studies by Feser *et al.* (2021) and Wolf *et al.* (2020) present evidence showing that significant changes in storminess have occurred in the North Atlantic over the last century. This work was corroborated by Alexandersson *et al.* (2000), who found relative storminess increased in the late 20th Century. Although a decline in storminess was noticed in the early 2000s (Matulla *et al.*, 2007), the general observations of an increase in storminess in the North Atlantic is also corroborated by similar studies into the long-term wave climate of the North Sea (Beniston *et al.*, 2007). However, Horsburgh *et al.* (2020) concluded that there is no observational evidence for long-term trends in either storminess across the UK or resultant storm surges, and simulations for storm surges over the 21st century suggest that there may not be significant changes to storm surges in the UK. The Wolf *et al.* (2020) summary on future projections on storms and waves concluded that future projections in waters surrounding the UK are sensitive to climate model projections for the North Atlantic storm track, which includes significant uncertainty.

18-117. Overall, it is generally accepted that the frequency and magnitude of higher energy events will increase into the future as the direct result of changes to the climate. In the near future, natural variability dominates any climate-related trends in storms and wave heights. Towards the end of the 21st century, there is some consensus that mean significant wave height is decreasing, with simulations suggesting a decline in Hs of 10-20% (Palmer *et al.*, 2018). However, the most extreme wave heights are projected to increase.

18-118. Sea level rise, in addition to other factors such as storms, anthropogenic disturbance and reduced sediment supply, could lead to an increase in the rate and/or magnitude of observed coastal erosion. Approximately 19% of the Scottish coastline is undergoing erosion, which particularly impacts soft coasts. The future baseline for coastal erosion for the Proposed Offshore Development is discussed in **Volume 1, Chapter 6: Marine and Coastal Physical Processes**.

18-119. Evidence suggests that climate change is having an impact on ocean stratification over the North-West European shelf sea, as the rise in temperature causes water to stratify earlier in the year and revert back to mixed conditions slightly later. The potential impact of climate change on stratification is discussed further in **Volume 1, Chapter 6: Marine and Coastal Physical Processes**.

18-120. Ocean pH is declining, indicating that seas globally are becoming more acidic. This trend lowers the chemical stability of mineral forms of calcium carbonate and is strongly linked to rising atmospheric CO_2 levels (NOAA, 2025). It is projected, with virtual certainty that this process of ocean acidification means that the future surface open ocean will experience further pH drops (IPCC, 2019).

18.7.4 Data Limitations and Assumptions

18-121. The data limitations and assumptions made in the GHG, Blue Carbon, CCR and ICCI assessments are set out in **Table 18-18**. Further details of the methodologies for the assessment are presented in respective assessment sections.

Table 18-18 Assumptions and Limitations for the GHG, Blue Carbon, CCR and ICCI assessments

ID	Assumption/Limitation	Discussion
GHG Assessment		
1	Some quantities for materials to be used during construction are not currently available.	Quantities of the main and most GHG intensive materials are included in the assessment. Furthermore, precautionary assumptions are adopted for quantities of known materials (i.e. using the maximum quantity in line with the Maximum Design Scenario approach). The quantities of key components or materials used in the assessment for both the Proposed Offshore Development and the Proposed Onshore Development are presented in **Table 18-31**.
2	Recycled content of construction materials is unknown	It has been assumed that all steel used for the Proposed Offshore Development is virgin steel to provide a precautionary assessment. However, from experience, steel used in construction would likely have a high recycled content, and thus a lower embodied carbon content than has been assumed in this assessment.
3	Lack of emission factors for future year activities, such as fuel consumption and material extraction.	The most recent and available emissions factors are used in the assessment to provide a precautionary assessment, as the emissions factors may change over time with the availability of new data and updated technology.
4	The specific nature and composition of some materials, such as the type of concrete or steel to be used, is unknown at this stage, which may affect the embodied carbon within a material.	If there is variation across different compositions of the same material, the 'General' option within the ICE database is chosen, if available, or the median value if not. This approach is appropriate in the absence of specific material information.
5	The construction port is unknown at this stage with multiple ports being considered.	A range of ports are being considered to be the marshalling port for construction vessels. The furthest port is Fife, and to adopt a conservative approach in the assessment, was used as the marshalling port for construction vessels with an assumed distance of 290 km to the Array Area.
6	Uncertainty regarding the decarbonisation of emission activities in the operation and maintenance phase.	Many sectors are anticipated to decarbonise over the next 35 years, and during the operation and maintenance phase, it is likely that the emissions intensity of producing materials and the movement of marine vessels would be less than the present day. Therefore, emissions predicted in this assessment for the operation and maintenance phase of the Proposed Offshore Development are likely to be an overestimation.
7	Travel distances for the vehicles during the construction phase	In the absence of specific travel distances for vehicles during the construction phase, heavy goods vehicles are assumed to travel 50 km per movement, and light vehicles (construction personnel) are assumed to travel 10 km per movement (one-way). These assumptions reflect typical distances between supply depots and sites, and light vehicles covering reasonable commuting distances for locally based or nearby accommodated workers.
8	Use of plant and equipment during the construction phase	The construction programme was used to calculate the use of plant and equipment during the construction phase. The operational duration of each construction plant and equipment was estimated based on the number of working days for each construction activity. Plant and equipment are assumed to operate for 11 hours per day based on the typical working schedule for the Proposed Onshore Development (Monday to Friday 8 am – 7 pm). In some circumstances, works such as the HDD operations will take place outside of normal working hours. An engine load factor of 75% and an on-time factor of 0.75 were assumed for each plant and equipment to enable a conservative assessment, which are assumptions based on previous project experience. In addition, the plant and equipment engine specifications were obtained from publicly available sources.
9	Lack of road vehicle movement information for the operation and maintenance phase of the Project	There are likely to be minimal road vehicle movements during the operation and maintenance phase of the Project and would be limited to periodic maintenance activities. The contribution to the GHG footprint of the Project is therefore considered to be negligible.
Blue Carbon Assessment		
10	Uncertainty regarding the remineralisation potential for the potentially disturbed sediment	As not all disturbed Blue Carbon reserves have remineralisation potential, a worst-case scenario has been adopted, which assumes that 100% of disturbed sedimentary carbon ends up as CO_2 flow to the atmosphere.
CCR Assessment		
11	Climate change projections	A key assumption of the climate change projection data from UKCP18 is that the model is strongly dependent on the future global GHG atmospheric concentrations and emission trajectories. The RCP scenarios cover a recent set of assumptions based upon future population dynamics, economic development, and account for international targets on reducing GHG emissions. Each RCP scenario has a different climate outcome, given that they are based upon a different set of assumptions. The two RCP scenarios presented within this chapter (RCP4.5 and RCP8.5) are considered the most likely to occur over the lifespan of the Proposed Offshore Development and present a range of outcomes in terms of climate projection data. However, the UKCP18 guidance cautions that the scientific community cannot reliably place probabilities on which scenario of GHG emissions is most likely. Due to the intrinsic uncertainty within climate change projections, the UKCP data is based upon probabilistic projections, generating a normally distributed model per output. The model outputs values for the 10th, 50th and 90th percentiles, which represents the range of uncertainty, and is therefore presented in this chapter. In addition, UKCP data do not cover all climate variables which may be relevant to the Study Area. Where information gaps exist, these are supplemented with other available literature sources.
12	Spatial resolution of the climate baseline	Climate change projections are provided for defined grid cells in the UKCP18 database. The size of the grid cell determines the spatial resolution of the projection data and how it corresponds to the Study Area. It is assumed that the climate baseline across the Study Area is adequately described by the selected grid cell. It should be noted that limited quantitative climate data is available for offshore locations and therefore the most appropriate onshore data has been used.

ID	Assumption/Limitation	Discussion
13	Temporal resolution of the climate baseline	Climate change projections are provided as a time series. For the purpose of the CCR assessment, the data is summarised, and average values presented for 20-year time periods which are selected based on the various phases of the Proposed Offshore Development, as set out in **Section 18.7.3.7**. It is assumed that these time periods are representative of current and future conditions within the Study Area and provide sufficient temporal coverage.

18.8 IMPACTS SCOPED OUT OF THE ASSESSMENT

18-122. The Proposed Offshore Development received a Scoping Opinion from Marine Directorate (SCOP 0031) in December 2023 which, alongside the understanding of Maximum Design Scenarios and environmental baseline conditions, has informed the impacts to be scoped out from further assessment in EIA. No potential impacts related to climate change were proposed to be scoped out of the assessment.

18.9 METHOD FOR ASSESSMENT

18.9.1 Overview

18-123. Assessment of likely significant effects in this chapter differs from the general approach outlined in **Volume 1, Chapter 5: EIA Methodology** of the EIAR. For this Climate Change Chapter, a topic-specific assessment is undertaken following the methodology and approach which is aligned with best practice guidance such as 'Assessing Greenhouse Gas Emissions and Evaluating their Significance' (IEMA, 2022) and 'Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation' (2020) for the GHG and CCR assessments respectively. The methodologies for the GHG, Blue Carbon and CCR assessments are detailed in the following sections.

18.9.2 GHG Assessment

18-124. The purpose of the GHG assessment is to consider the potential impacts and assess the likely significant effects of the Project on climate change via GHG emissions created and avoided during the construction (including pre-construction), operation and maintenance, and decommissioning phases. Emissions and their effect significance are presented separately for each phase of the Project. Total emissions arising over the Project lifecycle are also provided to assess the likely significant effects of the Project.

18-125. Volume 3, Appendix 18.1: Greenhouse Gas Assessment Methodology expands on the methodology detailed in **Section 18.9.2.1**, including further context on the climate change benefits of offshore wind and GHG emission sources for offshore wind farms, and the methodology for the quantification of GHG emissions for each emission source. As discussed in Section 18.7.4 and Volume 3, Appendix 18.1: Greenhouse Gas Assessment Methodology, there are inherent uncertainties associated with carrying out GHG footprint assessments for offshore wind projects, although the approach to determine emissions from individual source groups is well-defined. The assumptions and limitations of the GHG footprint assessment are detailed in **Section 18.7.4**.

18.9.2.1 GHG Assessment Approach

18-126. In this assessment the term 'GHG' or 'carbon' encompasses CO_2 and the six other gases as referenced in the Kyoto Protocol, CH_4, N_2O, HFC's, PFCs, SF_6 and NF_3. The results in this assessment are expressed in units of CO_2e, which recognises that different gases have notably different global warming potentials.

18-127. GHG emissions arising from the construction, operation and maintenance, and decommissioning phases of the Project have been assessed within the Study Area, which is outlined in **Section 18.5.1**. GHG emissions have been quantified using a standard calculation-based methodology, which involves multiplying activity data gathered for the Project with the relevant emission factors. Where full details of activity data were not available, industry benchmarks and assumptions using professional judgement have been utilised.

18-128. To account for each phase of the Project, GHG emissions have been calculated separately for construction, operation and maintenance, and decommissioning. In addition, a whole life cycle assessment has been undertaken, which accounts for the 'net effect' of the Project, whereby avoided emissions from the displacement of electricity, which would have otherwise been generated from other forms of generation, are quantified.

18-129. The additional parameters also calculated to contextualise the outcomes of the assessment for each phase and the lifecycle assessment are described in **Table 18-19**.

Table 18-19 Additional Parameters for the GHG Assessment

Parameter name	Project Phase	Description
Comparison to UK and Scottish Carbon Budgets	• Construction • Operation and maintenance	Construction, and operation and maintenance phase emissions were calculated as a percentage of the UK and Scottish Carbon Budgets to which the phase of the Project corresponds to.
Avoided emissions	• Operation and maintenance	Avoided GHG emissions are calculated from the provision of renewable energy to the grid, which would otherwise have been generated using natural gas The emission factor for the use of natural gas considers operational emissions at a gas-fired power station only, and therefore does not account for other lifecycle carbon impacts. To enable a comparable metric, emissions from the construction and decommissioning phases have been excluded from this calculation.
GHG intensity of produced electricity	• Operation and maintenance • Whole lifecycle	The amount of GHGs released per unit of electricity generated, typically expressed as grams (g) of CO_2e per kWh.

Emissions Calculation

18-130. In order to account for all the relevant emission sources within the Study Area for the Project, emission sources have been categorised in accordance with the PAS 2080:2023 life cycle modules (BSI, 2023). PAS 2080:2023 is a specification for whole-life carbon management when delivering infrastructure projects and aligns with the approach advocated in The Carbon Trust's guidance (2024).

18-131. GHG emissions sources arising from the Project have been categorised by lifecycle module, and divided by source type within each module, as detailed in **Table 18-20.**

Table 18-20 GHG Emissions Sources Considered in the GHG Assessment

Project Phase	Lifecycle Module	Source and detail
Construction	A0 – pre-construction surveys and site preparation works	Fuel and electricity consumption for pre-construction surveys and activities, including site preparation works (e.g., vehicles and vessels).
	A1 – Material supply, A2 – Material transport, A3 – Manufacturing energy	Embodied emissions within materials used to construct the Project comprising GHG emissions released throughout the supply chain (i.e., wind turbines, offshore export cables, onshore cables, onshore substation). This includes the extraction of raw materials, transport, manufacturing, assembly, and their end-of-life profile.
	A4 – Transportation to / from site	Fuel consumption in marine vessels travelling to / from their origin location to the marshalling port(s) for the construction phase and between the port(s) and the Proposed Offshore Development Site. Fuel consumption in vehicles transporting materials/components to the Proposed Onshore Development. Fuel consumption in helicopters used during construction for the Proposed Offshore Development.
	A5 – Construction	Fuel consumption in vessels and vehicles undertaking construction activities for the Project.
Operation and Maintenance	B2 – Maintenance, B3 – Repair, B4 – Replacement	Fuel consumption in marine vessels used during the operation and maintenance phase for the Proposed Offshore Development. Fuel consumption in helicopters used during operation Proposed Offshore Development. Fuel consumption in vehicles used during the operation and maintenance phase of the Proposed Onshore Development. Embodied carbon in materials used for spare parts during the operation and maintenance phase of the Project.
	D2 – Avoided emissions	Avoided emissions from the provision of renewable energy by the Project to the NETS.
Decommissioning	C1 – Deconstruction and demolition, C2 – Transport to / from site, C3 – Waste processing / recovery, C4 – Disposal, C5 – Relandscaping	End-of-life emissions.

18-132. The following life cycle modules from the PAS 2080:2023 specifications were not considered in the assessment:

- B1 – 'Use' – insufficient information on SF6 leakages to quantify the associated emissions;
- B5 – 'Refurbishment' - the Project is unlikely to undergo refurbishment during its operational lifetime. Should repowering or lifetime extension options be considered, this would be subject to a separate consent;
- B6 – 'Operational energy use' - energy requirements of the Project during the operation and maintenance phase are likely to be minimal (e.g., temporary generators for WTG startup) and are assumed to be offset by the electricity that is generated;
- B7 – 'Operational water use' – there is anticipated to be minimal operational water consumption by the Project; and
- B8 – 'Other Operational Emissions' – not applicable to the Project.

18-133. The approach to quantifying GHG emissions for each phase of the Project and lifecycle module is detailed in **Appendix 18.1: Greenhouse Gas Assessment Methodology**. The total operational life of the Project is anticipated to be 35 years.

Land Use and Land Use-Change

18-134. Natural habitats act as carbon stocks and sequester carbon. Changes to land-use associated with the Proposed Onshore Development could result in impacts to carbon sequestration rates.

18-135. A detailed assessment of temporary and permanent land use, as well as land-use change emissions resulting from vegetation and soil disruption or loss during the construction and operation and maintenance phases of the Proposed Onshore Development could not be undertaken at the time of assessment. This is because information regarding the extent of temporary and permanent land change is yet to be determined because the onshore assessments were still ongoing at the time of this assessment.

18-136. However, the construction of the Onshore Substation is expected to lead to a small area of permanent land use change from areas of vegetation to hardstanding, which is estimated to be approximately 75,000 m^2. There will also be a small area of permanent land use change at the Landfall Area. In addition, the installation of the buried onshore cables, including joint bays, may result in areas of temporary land use change.

18-137. Given the low area of permanent land use change, and the majority of activities associated with the Proposed Onshore Development will result in only a temporary change of land use, effects on carbon sequestration rates are expected to be minimal, and would not change the outcome of the GHG assessment.

18-138. Emissions associated with any land use change for the Proposed Offshore Development are accounted for in the Blue Carbon assessment.

Definitions of Sensitivity and Magnitude

Sensitivity

18-139. The receptor for the GHG assessment is the global atmosphere. As such, it is affected by all global sources of GHGs and is therefore considered to be of high sensitivity to additional emissions.

Magnitude

18-140. The magnitude of impact is not defined, as the effect significance for the GHG assessment is not determined by the magnitude of GHG emissions alone. The IEMA guidance (IEMA 2022) states *"the crux of significance therefore is not whether a project emits GHG emissions, nor even the magnitude of GHG emission alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero".* However, GHG emissions during the construction, operation and maintenance and decommissioning phases have been calculated as part of the assessment, by individual phases and combined over the whole lifecycle.

18-141. The impact of GHG emissions is, by nature, global and long term with low reversibility, owing to the long atmospheric lifetime of GHGs and their prolonged effect on the climate system.

Significance of Effect

18-142. The IEMA guidance (IEMA, 2022) recognises "*when evaluating significance, all new GHG emissions contribute to a negative environmental impact; however, some Projects will replace existing development or baseline activity that has a higher GHG profile. The significance of a project's emissions should therefore be based on its net impact over its lifetime, which may be positive, negative or negligible*".

18-143. The IEMA guidance (IEMA, 2022) recommends that significance criteria align with Paris Agreement, the UK's Carbon Budgets and net zero commitments: *"the crux of significance is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050*".

18-144. The IEMA guidance provides relative significance descriptions to assist assessments, specifically in the EIA context. Section VI of the IEMA guidance (IEMA, 2022) describes five distinct levels of significance which are not solely based on whether the Proposed Offshore Development emits GHG emissions alone, but how the project makes a relative contribution towards achieving a science-based 1.5°C aligned transition towards net zero. These are presented in **Table 18-21.**

Table 18-21 Assessment Significance Criteria, as Obtained from the IEMA Guidance (IEMA, 2022)

Significance	Definition
Major adverse	The Project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to Scotland's and the UK's trajectory towards net zero.

Significance	Definition
Moderate adverse	The Project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to Scotland's and the UK's trajectory towards net zero.
Minor adverse	The Project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the Scotland's and the UK's trajectory towards net zero.
Negligible	The Project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before Scotland and the UK's targets of 2045 and 2050 respectively. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
Beneficial	The Project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

18-145. The significance of effect of each phase of the Project is firstly evaluated. As discussed in **Section 18.9.2.1**, an overall significance of effect is then determined for the whole life cycle assessment, and which considers the net contribution of the Project to climate change.

18-146. For the construction phase, significance is determined by comparing the contribution of emissions to the 5th UK Carbon Budget (2028 - 2032) and 6th Carbon Budget (2033 – 2037) and therefore the effect of the Project on the UK's ability to meet its future Carbon Budgets. In addition, construction phase emissions were also compared to the 1st (2026 – 2030) and 2nd (2031 – 2035) Scottish Carbon Budgets.

18-147. For the operation and maintenance, and decommissioning phases, the relevant UK and Scottish Carbon Budgets have not all been set or do not fully apply, as the Project's operational lifetime extends beyond 2045 (the latest current date the Scottish Carbon Budgets extend to) and 2050, the year which the UK commits to achieving net zero. Therefore, significance of effect for these phases is determined by considering the impact of Project on the UK's and Scotland's ability to achieve and maintain its net zero status. The first year of the operation and maintenance phase sits within the final year of the 6th Carbon Budget (2033-2037) and the subsequent five years sit within the 7th Carbon Budget (2038-2042). In addition, operation and maintenance phase emissions were also compared to the 3rd (2036 – 2040) and 4th (2041 – 2045) Scottish Carbon Budgets.

18-148. The whole life cycle emissions assessment is contextualised using a comparison to emissions avoided from the displacement of electricity which would have otherwise been generated by other means.

18-149. Effects identified within the assessment as major / moderate adverse or beneficial are deemed to be likely significant effects in EIA terms within this chapter. Whilst only one level of significance criteria is provided where there is a net reduction in emissions, further context with respect to the level of emissions avoided compared to the baseline scenarios is provided in **Section 18.12.1.4.**

18.9.3 Blue Carbon Assessment

18-150. The main threat to long-term carbon storage is any disturbance to sediment top layers, such as construction activities for the inter-array and offshore export cables or anchor installation. Resuspension of sediment allows rapid consumption of buried carbon by organisms, reducing the carbon burial rate and Blue Carbon storage. The assessment has therefore been undertaken to assess the likely significant effects of the Proposed Offshore Development on Blue Carbon habitats and sediments, including:

- direct Blue Carbon benthic habitat loss/disturbance as a result of the Proposed Offshore Development; and
- direct Blue Carbon loss through potential CO_2 emissions from disturbed sediments.

18-151. These impacts are likely a result of the following activities:

- mooring systems and anchors;
- OSPs and associated supporting structures;
- foundations;
- scour protection;
- cable installation; and
- seabed preparation (i.e. boulder clearance, PLGR, UXO clearance and pre-sweeping).

18-152. The Blue Carbon assessment primarily focused on the Proposed Offshore Development Site, as this is where habitats and sediments containing blue carbon are situated. There is also the potential for the release of carbon if habitats in the Landfall Area are disturbed. As outlined in Section 4.4.2.5 of Volume 1, Chapter 4: Project Description, no open-cut trenching will be undertaken at the Landfall Area, which is situated within the Intertidal Region. This approach minimises the potential for surface disturbance, reduces erosion and sedimentation, preserves root systems, and lowers the risk of contamination. This helps to maintain the integrity of ecosystems in the Landfall Area, ensuring they continue to provide vital services such as carbon sequestration. Therefore, the potential for the release of carbon from habitats in the Landfall Area is considered to be negligible.

18.9.3.1 Benthic Habitats - Assessment Methodology

18-153. The Blue Carbon Assessment for benthic habitats evaluates the potential loss of carbon sequestering or donating habitats associated with each phase of the Proposed Offshore Development. The Assessment builds upon the methodology and results presented in **Volume 1**, **Chapter 7: Benthic Intertidal Ecology** and **Volume 3, Appendix 7.1 Environmental Survey Report** but focuses specifically on the potential impact of the Proposed Offshore Development on Blue Carbon habitats.

18-154. The assessment was informed by data in the Marine Life Information Network (MarLIN) database, which offers comprehensive data on UK marine species and habitats. It provides detailed information on species distribution, sensitivity, and ecology, which helps assess the impacts of offshore activities.

18-155. The assessment combines the sensitivity of the Blue Carbon Habitat (the receptors, as identified in **Table 18-9**) with the impact magnitude to determine the overall likely significance of effect. Sensitivity and magnitude criteria have been derived using professional judgement and the MarLIN database, as detailed in **Table 18-22**, **Table 18-23** and **Table 18-24**.

Sensitivity

18-156. The sensitivity of a receptor is a function of its capacity to accommodate change and reflects its ability to recover if it is affected, and is defined by the following factors:

- adaptability - the degree to which a receptor can avoid, adapt to or recover from an effect;
- tolerance - the ability of a receptor to accommodate temporary or permanent change; and
- recoverability - the temporal scale over and extent to which a receptor will recover following an effect.

Table 18-22 Receptor Sensitivity Criteria

Sensitivity of receptor	18-157. Definition
High	Receptor has very limited or no capacity to accommodate physical or chemical changes or influences, with a low ability to recover or adapt. The receptor has a very high carbon stock or sequestration rates.
Medium	Receptor has a limited or low capacity to accommodate physical or chemical changes or influences, with a low ability to recover or adapt. The receptor has a moderate carbon stock or sequestration rates.
Low	Receptor has a limited tolerance to accommodate physical or chemical changes or influences or will be able to recover or adapt. The receptor has a low carbon stock or sequestration rates.
Negligible	Receptor is generally tolerant of and can accommodate physical or chemical changes or influences, without the need to recover or adapt. The receptor has a negligible carbon stock or sequestration rates.

Magnitude

18-158. The magnitude of an impact is for the purposed of this assessment defined by four factors:

- extent - the area over which an effect occurs;
- duration - the time for which the effect occurs;
- frequency - how often the effect occurs; and
- severity - the degree of change relative to existing environmental conditions.

Table 18-23 Magnitude Criteria for the Blue Carbon Assessment

Magnitude	Definition
High	The impact occurs over a large spatial extent, resulting in widespread, long-term, or permanent changes in baseline conditions. It is very likely to occur and/or will occur at a high frequency or intensity, leading to the loss of resource and/or quality of the resource and permanent or irreplaceable change, which is likely to occur.
Medium	The impact occurs over a local to medium extent with a short- to medium-term change to baseline conditions. It is likely to occur at a moderate frequency or intensity, leading to a minor loss of, or alteration to, a resource and/or quality of the resource. This results in a long-term but reversible change, that is likely to occur.
Low	The impact is localised and short-term, leading to a detectable change in baseline conditions or a noticeable effect on a small proportion of a receptor population. It is unlikely to occur or may occur at a low frequency or intensity, resulting in a very minor loss of, or alteration to, a resource and/or quality of the resource. This causes a noticeable short- to medium-term but reversible change, that could possibly occur.
Negligible	The impact is highly localised and short-term, with full rapid recovery expected, resulting in very slight or imperceptible changes to baseline conditions. It is very unlikely to occur; if it does, it will be at a very low frequency or intensity. This leads to a temporary or intermittent very minor loss of, or alteration to, a resource and/or quality of the resource. The change is short-term, intermittent, and reversible, and is unlikely to occur.

Significance of Effect

18-159. The significance of an effect is determined by combining the predicted magnitude of the impact with the sensitivity of the receptor, as defined in **Table 18-24.** Effects are considered to be a likely significant effect in the context of EIA Regulations if they are assessed as 'Moderate' or above.

Table 18-24 Blue Carbon Impact Assessment Matrix

Receptor sensitivity	Magnitude of Impact			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major / Moderate	Moderate	Minor
Medium	Moderate / Major	Moderate	Minor / Moderate	Minor
Low	Moderate	Minor / Moderate	Minor	Negligible / Minor
Negligible	Minor / Moderate	Minor	Negligible / Minor	Negligible

18.9.3.2 Blue Carbon Loss - Assessment Methodology

18-160. The assessment also identifies and, where possible, quantifies the Blue Carbon stock that may be lost or disturbed as a result of the Proposed Offshore Development.

18-161. The Blue Carbon calculations from disturbed sediments have been undertaken using a combination of publicly available data and scientific literature (i.e. Smeaton *et al.*, 2021a; 2021b).

18-162. For sediment carbon content calculations, OC and IC content data was extracted from Smeaton *et al.,* (2021b) and overlain with the location of the Proposed Offshore Development Site. Not all disturbed Blue Carbon reserves have remineralisation potential; however, a conservative approach was adopted, which assumes 100% of disturbed sedimentary carbon ends up as a CO_2 flow to the atmosphere.

18-163. Blue Carbon loss was calculated by calculating the total amount of OC and IC in the top 10 cm of sediment, within areas of seabed take associated with the provision of infrastructure in the Proposed Offshore Development Site. The areas of seabed take are listed in **Table 18-25.**

Table 18-25 Seabed Take of Infrastructure Associated with the Proposed Offshore Development

Project feature	Seabed take (km^2)	Percentage cover of the Proposed Offshore Development Site (%)
Mooring Systems	0.15	0.04%
Suction Pile anchors	0.48	0.11%
OSPs and IRCs	0.08	0.02%
IACs protection	0.34	0.08%
Export and interconnector cables protection	1.65	0.39%
Total	**2.70**	**0.63%**

18-164. The receptor for the assessment is the global atmosphere. Therefore, the same significance criteria as for the GHG assessment (presented in **Table 18-21**) was adopted for the loss of Blue Carbon through sediment disturbance.

18.9.4 CCR Assessment

18-165. The CCR assessment considers the resilience and vulnerability of the Proposed Offshore Development to the projected effects of climate change over the construction, operation and maintenance, and decommissioning phases. This assessment identifies the likelihood of climate hazards occurring within the Study Area, and the consequences of the impact.

18-166. The future baseline for the CCR assessment is defined considering the climatic conditions that would be experienced during all phases of the Proposed Offshore Development:

- the overall duration of the construction phase is anticipated to be six years. Construction is expected to begin in 2030 and to be complete to enable full operation by 2035;
- for the purposes of the EIA, the design lifespan of the Proposed Offshore Development is assumed to be 35 years, although it is acknowledged that there may be additional time for operating the Array under the terms of the agreement between the Applicant

and Crown Estate Scotland. The operation and maintenance phase of the Proposed Offshore Development is therefore considered within the climate periods of 2030-2049 and 2050-2069; and

- Decommissioning would take place at the end of the operational lifetime. Decommissioning is therefore considered to take place within the climate period of 2060-2079.

18-167. The methodology adopted for the CCR assessment is informed by IEMA guidance, Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation (IEMA, 2020). This guidance provides a framework for the consideration of climate change resilience and adaptation in the EIA process. The guidance advises that future climate conditions within the Study Area should be identified and assessed with consideration of how adaptation and resilience measures have been built into the design of a development. As the CCR assessment considers climate change impacts on the Proposed Offshore Development, as opposed to vice versa, its assessment methodology is also topic-specific and differs from the general EIA approach presented in **Volume 1, Chapter 5: EIA Methodology** of the EIAR.

18-168. The sources of information presented in **Table 18-6** were used to inform the CCR assessment.

18-169. As the construction phase of the Proposed Offshore Development is expected to be complete to enable full operations by 2035, the degree of climatic change over this period, as distinct from standard weather fluctuations, is not likely to result in significant changes from present day conditions (see **Section 18.7.3**), when compared to the operational timeframe where change in the climate related hazard is more likely. Therefore, a high-level assessment of climate change risk is undertaken for the construction phase.

18-170. For the purpose of the CCR assessment, the following key terms are adopted:

- climate variable: a measurable, monitorable aspect of the weather or climate conditions such as temperature and wind speed;
- climate hazard: a weather or climate-related event or trend in climate variable, which has potential to do harm to receptors such as increased precipitation or storms; and
- climate change impact: an impact from a climate hazard which affects the ability of the receptor to maintain its functions or purpose.

18-171. A four-step methodology has been adopted for the CCR assessment in line with industry good practice, as follows:

- Step 1 – identifying receptors, climate variables and hazards;
- Step 2 – climate vulnerability assessment;
- Step 3 – climate risk assessment; and
- Step 4 – resilience rating.

18-172. Step 1 of the approach informs the understanding of the baseline environment, and the methodology for this stage is set out in **Section 18.9.4.1** below.

18-173. Steps 2 to 4 of the CCR assessment progress through a qualitative vulnerability assessment, identification of relevant climate hazards, assessment of the risk to the Proposed Offshore Development associated with the occurrence of a hazard event, identification of mitigation measures and assessment of effect significance. These assessment stages are explained in **Sections 18.9.4.2**, **18.9.4.3** and **18.9.4.4**.

18.9.4.1 CCR Assessment Step 1 - identifying receptors, climate variables and hazards

18-174. The first step of the CCR assessment is to identify the receptors which may potentially be impacted by climate variables and associated hazards. The identified receptors include those known to have already experienced a climate related event (e.g. receptors in known flood zones), and unknown receptors which are likely but are yet to be impacted according to available data and literature. Receptor types considered in the CCR assessment include infrastructure (temporary and permanent), human and environmental receptors, in accordance with the IEMA guidance (IEMA, 2020).

18-175. Key climate hazards relevant to the Study Area are identified based on desk-based sources, along with climate variables which could be used to quantify or contextualise the climate hazard under current and future climate conditions and the receptors which they affect.

18-176. Climate change projection data has been obtained from the UKCP18 database (Met Office, 2022a) and used to identify the climate variables within the Study Area for two RCPs. RCP scenarios are recent assumptions about future population, economy, and global targets to cut GHG emissions. The RCP scenarios used for the CCR assessment are defined in **Table 18-15** Data was obtained for the 10th, 50th and 90th percentiles for each RCP, in accordance with the IEMA guidance (IEMA, 2020) and the requirements for the National Policy Statement for energy (EN-1) (DESNZ,2023).

18-177. Climate projection data has been supplemented with information from other literature sources, including the future baseline trends and relevant impact assessments discussed in **Volume 1, Chapter 6: Marine and Coastal Physical Processes**.

18.9.4.2 Step 2: Climate Vulnerability Assessment

18-178. The second step consists of a qualitative vulnerability assessment of the Proposed Offshore Development to changes in the climate variables, informed by professional judgement and supporting literature. IEMA and industry experts have defined vulnerability as the degree of response of a receptor to a change in the environment, considering the capacity to accommodate or recover from change, and is a function of:

- sensitivity: the potential for the receptor to be affected by change; and
- exposure: the spatial and temporal exposure of the receptor to climate variables.

18-179. Both the sensitivity and the exposure of the Proposed Offshore Development to climate hazards are considered to determine vulnerability, accounting for any embedded mitigation measures (refer to **Section 18.11**). This approach attributes a high, moderate, or low vulnerability rating to each climate hazard identified based on the interrelationships between sensitivity and exposure, as set out in **Table 18-26**.

Table 18-26: CCRA Sensitivity-Exposure Matrix for Determining Climate Vulnerability

Sensitivity	**Exposure**		
	Low	Moderate	High
Low	Low vulnerability	Low vulnerability	Low vulnerability
Moderate	Low vulnerability	Medium vulnerability	Medium vulnerability
High	Low vulnerability	Medium vulnerability	High vulnerability

18-180. Climate change impacts upon the Proposed Offshore Development potentially arise when receptors have a combination of moderate to high level of sensitivity and/or exposure and are therefore vulnerable to climate hazards. The nature of any climate change impacts is also described alongside the vulnerability assessment to specify how the Proposed Offshore Development and its receptors are likely to experience the climate hazard and the outcomes.

18-181. For those vulnerabilities categorised as medium or high, the risk of climate change to the Proposed Offshore Development, and consequently to its operation, is then determined through Steps 3 to 4 of the CCR assessment process. Hazards with low vulnerability are screened out from further assessment due to the low potential for likely significant effects and negligible associated impacts. This is in line with risk assessment approach proposed by the European Commission in its guidance note whereby only potentially significant risks from climate change are taken forward for detailed analysis (EC, 2021).

18-182. Further information related to the vulnerability of the Proposed Offshore Development to the projected impact of climate change was obtained from other topic chapters including **Volume 1, Chapter 6: Marine and Coastal Physical Processes**.

18.9.4.3 Step 3: Climate Risk Assessment

18-183. For those vulnerabilities categorised as medium or high, the risk to the Proposed Offshore Development and its associated infrastructure due to the occurrence of a hazard event were qualitatively assessed based on a hazard likelihood and consequence matrix. The descriptors of likelihood and consequence are provided in

18-184. **Table** 18-27 and **Table 18-28** and the matrix is provided as **Table 18-29**.

Table 18-27: Descriptors of Likelihood for Climate Hazards

Likelihood	**Description**
Almost certain	The climate hazard is likely to occur numerous times during the anticipated operational lifetime of the Proposed Offshore Development.
Likely	The climate hazard is likely to occur on several occasions during the anticipated operational lifetime of the Proposed Offshore Development.
Moderate	The climate hazard will occur on limited occasions during the anticipated operational lifetime of the Proposed Offshore Development.
Unlikely	The climate hazards will occur infrequently during the anticipated operational lifetime of the Proposed Offshore Development.
Very unlikely	The climate hazard may occur once during the anticipated operational lifetime of the Proposed Offshore Development.

Table 18-28: Descriptors of Consequences Due to Climate Hazards

Consequence	Description
Catastrophic	Permanent damage to infrastructure, resulting in a severe lasting effect on the Proposed Offshore Development to function. Very significant adverse effect to the surrounding environs requiring remediation and restoration.
Major	Extensive damage to infrastructure requiring major repairs and maintenance, resulting in a severe effect on the Proposed Offshore Development to function. Significant adverse effect to the surrounding environs.
Moderate	Limited damage to infrastructure requiring maintenance or minor repair, resulting in a potential effect on the Proposed Offshore Development to function. Adverse effect to the surrounding environs.
Minor	Small and localised damage to infrastructure and a minor effect on the Proposed Offshore Development to function. Potential for slight adverse effect to the surrounding environs.
Insignificant	No damage to infrastructure or the ability of the Proposed Offshore Development to function. No adverse effect to the surrounding environs.

Table 18-29: Likelihood/Consequence Matrix for Determining Risk Rating

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Low	Medium	High	Extreme	Extreme
Likely	Low	Medium	Medium	High	Extreme
Moderate	Low	Low	Medium	High	Extreme
Unlikely	Low	Low	Medium	Medium	High
Very unlikely	Low	Low	Low	Medium	Medium

18.9.4.4 Step 4: Resilience rating

18-185. For climate change risks identified as ‘medium’, ‘high’ or ‘extreme’ in Step 3 (see

18-186. **Table** 18-29), secondary mitigation measures are identified, which would be in addition to the embedded mitigation measures (**Section 18.11**). Considering the proposed mitigation measures, a residual risk rating is then determined. For each risk, the resilience rating is defined as one of the following:

- High level of climate resilience - remedial action or adaptation may be required but is not a priority;
- Moderate level of climate resilience - remedial action or adaptation is recommended; and
- Low level of climate resilience - remedial action or adaptation is required as a priority.

18.9.4.5 Effect Significance

18-187. For climate change risks assessed in Step 2 as having a low vulnerability, the significance of the CCR assessment is determined as ‘not significant’.

18-188. For climate change risks assessed as having a moderate or high vulnerability, the likely significance of the effect assessed by the CCR assessment is determined based on the assessment of residual risk (Step 3) and the resilience rating (Step 4) for each climate change impact. The matrix presented in **Table 18-30** is based on industry good practice for climate resilience risk assessment and was used to establish the significance of each climate change impact based on the risk and resilience ratings.

Table 18-30: Significance Criteria

Risk rating	**Resilience rating**		
	High	**Minor**	**Low**
Low	Not significant	Not significant	Not significant
Medium	Not significant	Not significant	Significant
High	Not significant	Significant	Significant
Extreme	Significant	Significant	Significant

18.10 MAXIMUM DESIGN SCENARIO

18-189. Details of the Proposed Offshore Development activities and key components are provided in **Volume 1, Chapter 4: Project Description**. As this assessment is using the Design Envelope approach, a Maximum Design Scenario has been selected for each impact which would lead to the greatest impact for all receptors or receptor groups, when selected from a range of values.

18-190. **Table 18-31** presents the Maximum Design Scenario for each impact associated with likely significant effects assessment on climate change along with justification.

Table 18-31 Maximum Design Scenarios Considered for Impacts for Assessment of Likely Significant Effect on Climate Change

Impact	Phase[1]			Maximum Design Scenario	Justification
	C	O	D		
GHG emissions	✓			Indicative Proposed Offshore Development construction programme: • Indicative six-year offshore construction programme Proposed Offshore Development infrastructure construction duration based on the maximum indicative duration of vessels on site: ○ seabed preparation – approximately 16 months; ○ floating hull – approximately 26 months; ○ substation and IRC – approximately 11 months; ○ export cable – approximately 12 months; ○ inter-array cable - approximately 25 months; and ○ WTG – 25 months. Indicative Proposed Onshore Development construction programme: • The construction duration is anticipated to be approximately three years	For the Proposed Offshore Development, an indicative construction duration is detailed considering likely weather downtime and vessel availability are built into scheduling. For the Proposed Onshore Development, the indicative construction programme is a duration of three years.
				Proposed Offshore Development Infrastructure: Installation of up to: • 70x WTGs with a nominal output of 14 MW; • 70x floating foundations ; • 630x offshore mooring lines (9 per foundation); • 630x offshore anchors (9 per foundation); • 3x OSPs and 3x foundations (suction piles); • 1x Intermediate Reactive Compensation (IRC) Platform 1x and foundation (suction piles); • 70x Inter-array cables (total length 210 km); • 3x Interconnector cables (2x 10 km, 1x 10 km); • 3x offshore export cables (total length 86.5 km); • Offshore mooring/anchor scour protection – 268,380 m^3; • IRC scour protection - 79,200 m^3; • OSP scour protection – 194,700 m^3 ; and • Proposed Offshore Development Site cable protection – up to 791,102.4 m^3. Proposed Onshore Development Infrastructure: • Landfall ○ HDD equipment footprint – 37,400 m^2; ○ Up to 3 transition joint bays; and ○ 1x satellite compound, size – up to 10,000 m^2. • Onshore Cable Route – Landfall to Onshore Substation ○ Up to 3 Onshore cable circuits (3 cables per circuit – 9 cables in total); ○ Up to 25 km cable length; ○ Up to 138 total cable joint bays; ○ Up to 2 main compounds, size up to 40,000 m^2; and ○ Up to 6 onshore satellite compounds, size – up to 30,000 m^2 for the largest compound.	For the Proposed Offshore Development, the OSP and IRC platform foundations are assumed as suction piles because as they are considered as the worst-case scenario for scour protection volume.

[1] C = Construction, O = Operation and Maintenance, D = Decommissioning

Impact	Phase[1]			Maximum Design Scenario	Justification
	C	O	D		

				• Onshore Substation
				  ○ 1 Onshore Substation, size - 75,000 m²; and
				  ○ Up to 1 main onshore construction compound of size 30,000 m².
				• Onshore Cable Route – Onshore Substation to Grid Connection point
				  ○ Up to 2 Onshore cable circuits (3 cables per circuit – 6 cables in total);
				  ○ Up to 2.5 km cable length;
				  ○ Up to 8 total cable joint bays; and
				  ○ 1x satellite compound, size – up to 10,000 m².	

	✓			Vessel movements during construction of the Proposed Offshore Development: • 2,540 vessel return trips; and • 91 x vessels.	Based on the maximum number of vessels required. Additional detail on the different vessel types associated with each vessel activity and duration is detailed in **Volume 3, Appendix 18.1: Greenhouse Gas Assessment Methodology.**
	✓			Road vehicle movements during construction of the Proposed Onshore Development: • 64,309 personnel (light vehicle) movements; and • 301,894 Heavy Goods Vehicle movements (including Abnormal Indivisible Loads).	Based on the onshore traffic assessment information.
	✓			Indicative number of helicopter movements during construction of the Proposed Offshore Development: • 129 return trips; and • 4x helicopters.	Based on the maximum number of helicopters likely to be used.
		✓		Operational life – 35 years Operation and maintenance vessel movements: • 140 return trips per year; and • 18 x vessels. Operation and maintenance helicopter movements: • 210 return trips per year; and • 1x helicopter. (light vehicle) One-way movements (light vehicle) by operation and maintenance personnel for the Proposed Onshore Development • 146 total personnel movements across the operational and maintenance phase for the Onshore Cable Circuits; and • 1,680 total personnel movements across the operational and maintenance phase for the Onshore Substation. Spare parts (information derived from literature)	Based on maximum number of vessel and helicopter movements. Spare part information derived from literature, as detailed design information is not yet available, but the literature numbers are suitably robust. Onshore operation and maintenance of road vehicle movements associated with the Onshore Cable Circuits are based on the minimum requirement of one annual inspection of the Onshore Cable Circuits, with the assumption that each cable joint bay (146 in total, including the Landfall Area to Onshore Substation and Onshore Substation to Grid Connection cable routes) will need to be inspected. The onshore substation inspection and maintenance frequency is unknown at this stage; however, it is anticipated that there could be up to four visits each month. Therefore, there are 1,680 visits over the lifetime of the Proposed Onshore Development.
Blue Carbon emissions	✓		✓	Blue Carbon habitat and sediment area within the Proposed Offshore Development Site: 415 km²	The total area of sediment and substrate based on the baseline environment presented in **Section 18.7.2**.
Climate change resilience		✓		Earliest full operational start date: 2035 Operational life: 35 years The CCR assessment considers the intermediate (RCP4.5) and high emission (RCP8.5) scenarios for the UKCP18 for the following timescales;2030-2049 and 2050-2069.	Climate projection data is available for various emission scenarios. RCP4.5 is used to present the intermediate case climate change outcomes and RCP8.5 is commonly used to represent worst case climate change outcomes.

Impact	Phase[1]			Maximum Design Scenario	Justification
	C	O	D		
GHG emissions and climate change resilience			✓	**Decommissioning phase** There is no final decision regarding the final decommissioning programme at this time. It is recognised that legislation and industry best practices change over time. It is also likely that the Project's infrastructure would be removed and reused or recycled where practicable. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and will be agreed upon with the regulator. The contribution from the decommissioning phase has been determined from the total GHG contribution in the construction and operation and maintenance phases, as detailed in **Volume 3, Appendix 18.1: Greenhouse Gas Assessment Methodology**. The CCR assessment considered the high emissions scenario (RCP 8.5) for the (2060-2079 period (Met Office, 2018a) which is deemed representative of the decommissioning phase.	Climate projection data is available for various emission scenarios. RCP4.5 is used to present the intermediate case climate change outcomes and RCP8.5 is commonly used to represent worst case climate change outcomes.

18.11 EMBEDDED MITIGATION AS PART OF THE PROPOSED OFFSHORE DEVELOPMENT

18-191. As part of the Proposed Offshore Development design process, several designed-in (embedded) mitigation measures have been proposed to reduce the potential for impacts on environmental receptors. As there is a commitment to implementing these measures, they are considered inherently part of the design of the Proposed Offshore Development and have therefore been considered in the assessment (i.e., the determination of magnitude, and therefore significance, assumes implementation of these measures). These measures are considered standard industry practice for this type of development. The embedded commitments relevant to Climate Change are presented in **Table 18-30**. and **Volume 3, Appendix 1.1: Commitments, Mitigation and Monitoring Register** which provides additional information on how these commitments are secured.

18-192. The IEMA GHG guidance (IEMA, 2022) highlights the importance of embedded mitigation in minimising GHG emissions. In addition, the IEMA GHG Management Hierarchy sets out a structure to eliminate, reduce, substitute and compensate emissions (IEMA, 2022). These principles are shown in **Table 18-33**. In response to these principles, the need for the Proposed Offshore Development in relation to achieving net zero targets for Scotland the UK, and decarbonisation of the energy sector is well established.

18-193. The design will prioritise resilience against hazards posed by existing extreme weather events and climate conditions. Additionally, where relevant, the design will incorporate adaptations to address future impacts of climate change (see **Table 18-32**). Where secondary mitigation measures are proposed, these are detailed in the impact assessment (**Section 18.11**).

Table 18-32 Embedded Mitigation Measures of Relevance to Climate Change

Reference	Embedded Mitigation Measure	Justification
EM4	Infrastructure will be micro-sited, where practicable, around any sensitive seabed habitats including Annex 1 habitat and Priority Marine Features (PMF) species to reduce impacts on these conservation features. Micro-siting will be informed by pre-construction surveys which will identify the location and extent of habitats and species..	Micro-siting will reduce impacts on these sensitive seabed habitats conservation features. Micro-siting will be informed by pre-construction surveys which will identify the location and extent of habitats and species.
EM8	Requirement for a Decommissioning Plan to be developed.	A Decommissioning Programme is required under Section 105 (2) of the Energy Act 2004 (as amended). It will outline the approach for decommissioning the Proposed Offshore Development. The Decommissioning Programme will be prepared in accordance with industry standard best practice and will include measures to reduce GHG emissions and the risk from climate related hazards. The plans will be prepared prior to the commencement of the decommissioning works.
EM9	Development of and adherence to a CaP (Cable Plan). The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring. The CaP will be informed by a Cable Burial Risk Assessment (CBRA).	The CaP will confirm planned cable routing, burial and any additional protection and will set out methods for post-installation cable monitoring (including for fish if required). The CaP will be prepared in accordance with industry standard best practice. The plans will be prepared prior to the commencement of the construction works following results from pre-construction surveys to identify the location and extent of habitats and species.
EM33	Inspection and Maintenance Programme: Regular maintenance regime to check the Project infrastructure..	To ensure the Proposed Offshore Development remains resilient to change during the operation and maintenance phase, where practicable
AEM54	Reducing the quantity of construction materials, activities and enhancing efficiency, in line with IEMA guidance: 'Assessing Greenhouse Gas Emissions and Evaluating their Significance' on mitigation.	The floating structures offer significant advantages over traditional fixed foundations, including reduced construction materials, fewer piling operations, and the need for smaller offshore construction vessels which reduces the GHG emissions associated with the Proposed Offshore Development.

Reference	Embedded Mitigation Measure	Justification
AEM55	The proposed Environmental Management Plan (pEMP) for the Proposed Offshore Development (Buchan Offshore Wind Ltd, 2025) will include provisions relating to risk assessments and health and safety protocols. The management plan will be implemented to cover the construction, operation and maintenance, and decommissioning phases of the Proposed Offshore Development. The plan will account for exposure of site workers and construction plant to extreme weather events and ensure appropriate preparation and response measures are in place to minimise their impacts.	The pEMP (Buchan Offshore Wind Ltd, 2025a) will reduce the vulnerability of the Proposed Offshore Development to climate change during the construction, operation and decommissioning phases, where practicable.
AEM56	The resilience of offshore structures against more challenging conditions resulting from climate change is implicitly addressed in the design of offshore structures which incorporates an estimated sea level rise attributed to climate change. Furthermore, the mobility of the seabed at the offshore wind farm is considered throughout the design lifespan.	To reduce the vulnerability of the Proposed Offshore Development to climate change hazards such as sea level rise during the operation and maintenance phase, where practicable.

18-194. The IEMA GHG guidance (IEMA, 2022) notes the importance of embedded mitigation in minimising GHG emissions from a project. The IEMA GHG Management Hierarchy is presented in **Table 18-33.** Taking into account that the primary purpose of the Project is to generate low carbon renewable energy, the process of reducing GHG emissions from the Project is guided by the IEMA GHG Management Hierarchy.

Table 18-33 IEMA GHG Guidance (IEMA, 2022) - Mitigation Hierarchy Specific to the Project

Hierarchy	Principle	Proposed Offshore Development Response
Do not build	Evaluate the basic need for the proposed project and explore alternative approaches to achieve the desired outcome(s)	The purpose and rationale for the Project is to tackle climate change by replacing existing high carbon energy generation. Therefore, a 'do not build' scenario could have the effect of perpetuating and exacerbating climate change. Consideration for alternatives to the Project is presented in **Volume 1, Chapter 3: Site Selection and Consideration of Alternatives**
Build less	Realise potential for re-using and/or refurbishing existing assets to reduce the extent of new construction required.	Offshore wind farms by their design are efficient in their use of materials. Minimising the use of steel is a key design feature of the approach during detailed design and procurement for the Project.
Build clever	Apply low carbon solutions (including technologies, materials and products) to minimise resource consumption and embodied carbon during the construction, operation, use of the Project, and at end-of-life.	The Project aims to use the latest, most efficient and effective turbines and offshore substation platforms, where practicable. This would be reviewed during the detailed design phase.
Construct efficiently	Use techniques (e.g., during construction and operation) that reduce resource consumption and associated GHG emissions over the life cycle of the project.	Offshore construction is by its nature expensive and relies on the use of highly specialised, efficient vessels and equipment with a dedicated and highly trained workforce. Opportunities to construct and operate efficiently to minimise resource consumption and reduce GHG emissions from activities associated with the Project will be considered as the design progresses.

18-195. The Proposed Onshore Development, which is subject to a separate onshore planning application to be submitted to Aberdeenshire Council, will include embedded mitigation measures into the design to reduce GHG emissions as part of the EIAR. Potential measures to reduce GHG emissions, subject to refinement and confirmation as part of the application for the Proposed Onshore Development, are likely to include:

- a Construction Method Statement (CMS) which will be developed and implemented for the construction phase of the Proposed Onshore Development. The CMS will detail construction methods, roles and responsibilities of involved parties, and mitigation measures to reduce GHG emissions during construction;

- an Outline Construction Environmental Management Plan, which will be developed and included as part of the application for the Proposed Onshore Development. The Outline Construction Environmental Management Plan will detail construction practices to reduce environmental impacts, including GHG emissions where applicable. The Outline Construction Environmental Management Plan will be further developed post-consent, and a detailed Construction Environmental Management Plan will be implemented prior to the start of construction activities; and
- a Decommissioning Plan will be developed for Proposed Onshore Development will be implemented prior to decommissioning activities taking place. The Decommissioning Plan will include measures to mitigate the impact on the environment, including GHG emissions.

18.12 ASSESSMENT OF EFFECT SIGNIFICANCE

18-196. The potential impacts arising from the construction, operation and maintenance and decommissioning phases of the Project, based on the Maximum Design Scenario listed in **Table 18-31**, have been considered in this section. An assessment of the likely significant effects of the Project on the climate change receptors caused by each identified impact is given below.

18.12.1 Impact 1 GHG Assessment

18-197. This section presents the GHG emissions associated with the construction, operation, and maintenance, and decommissioning phases of the Project. The carbon benefits of the Project are presented, including the quantity of the GHG emissions saved (or avoided) and the GHG intensity of the electricity produced by the Proposed Offshore Development as described in **Table 18-19**.

18.12.1.1 Construction Phase

18-198. The emission sources considered for the construction phase of the Project were categorised into lifecycle modules A0, A1, A2, A3, A4, and A5. GHG emissions were quantified in accordance with the methodology outlined in **Section 18.9.2** and **Appendix 18.1: Greenhouse Gas Assessment Methodology**.

18-199. Based on the Maximum Design Scenario outlined in **Section 18.10**, emissions predicted to be released during the construction phase are shown in **Table 18-34**, and are listed by lifecycle module and source group.

Table 18-34 Construction Phase GHG Emissions

Lifecycle Module	Source group	GHG emissions (tonnes CO_2e)	Percentage of construction phase emissions for the Project
Proposed Offshore Development			
A0 (pre-construction)	Marine vessels	20,953	1.4%

Lifecycle Module	Source group	GHG emissions (tonnes CO_2e)	Percentage of construction phase emissions for the Project
A1 – A3 (embodied carbon)	Embodied carbon in materials	694,619	45.9%
A4 (transport to site)	Marine vessels (transit) and helicopter	23,888	1.6%
A5 (Construction)	Marine vessels (on site)	151,325	10%
Proposed Offshore Development Sub-Total		**890,785**	**58.9%**
Proposed Onshore Development			
A0 (pre-construction)	Plant and equipment	476	0.03%
A1 – A3 (embodied carbon)	Embodied carbon in materials	486,626	32.2%
A4 (transport to site)	Road vehicles	24,789	1.6%
A5 (Construction)	Plant and equipment	12,294	0.8%
Proposed Onshore Development Sub-Total		**524,186**	**34.7%**
Total Construction Phase Emissions		**1,414,971**	**93.6% (of total Project emissions)**

18-200. GHG emissions released during the construction phase were estimated to be 1,414,971 tonnes CO_2e. The Proposed Offshore Development is predicted to contribute 58.9% (890,785 tonnes CO_2e) of emissions during the construction phase of the Project, with embodied carbon in materials forming the largest source. Likewise, the embodied carbon in materials is also predicted to be the largest source of emissions during the construction of the Proposed Onshore Development.

18-201. A large proportion of the embodied carbon emissions is attributed to the use of steel due to its high embodied carbon content and the quantities required for the Proposed Offshore Development. It has been assumed that virgin steel would be used, which is a conservative assumption and is likely to result in an overestimation of emissions.

Comparison to UK and Scotland's Carbon Budgets

18-202. The construction phase of the Project is anticipated to commence in 2030 and conclude to enable full operations by 2035. It would therefore fall within the UK's 5th Carbon Budget period (2028 to 2032) and 6th Carbon Budget period (2033 to 2037). Estimated emissions during the construction phase would constitute approximately 0.04% and 0.07% of the UK's 5th and 6th Carbon Budgets respectively. This forms a relatively small proportion, and GHG emissions during construction would occur over a short duration as a single occurrence.

18-203. The construction phase of the Project aligns with Scotland's recommended 1st Carbon Budget period (2026 to 2030) and 2nd Carbon Budget period (2031 to 2035), with estimated emissions representing approximately 0.1% and 0.9% of these budgets, respectively. While the proportion of emissions relative to Scotland's recommended Carbon Budgets is higher than at the UK level, GHG emissions would occur over a short, defined period, and would facilitate the Project's long-term contribution in supporting Scotland's decarbonisation targets through the provision of renewable energy to the NETS.

18-204. It should be noted that a portion of GHG emissions, particularly embodied carbon, are likely to occur outside the territorial boundary of the UK, and hence outside the scope of the UK's and Scotland's national Carbon Budgets, policy and governance, given the international nature of supply chains. However, considering the need to avoid 'carbon leakage'[2] overseas when reducing UK and Scottish emissions, and as GHG emissions affect the climate system wherever they occur, the full contribution of embodied carbon has been included in the comparison to relevant carbon budgets.

Significance of Effect

18-205. As the GHG emissions from the construction phase are considered to have a relatively small contribution to the relevant Carbon Budgets, and with reference to the criteria outlined in **Table 18-21** is considered to be fully consistent with policy requirements and good practice design standards. Construction of the Project is therefore considered to be unlikely to adversely affect the UK's and Scotland's ability to meet its future Carbon Budgets.

18-206. Therefore, in accordance with the criteria outlined in **Table 18-21**, the Project's construction emissions are considered to have a Minor Adverse effect on climate change, which is Not Significant in EIA terms. Moreover, it should be noted that construction emissions would only be released once to enable the operation of the Project and the provision of renewable energy to decarbonise the NETS in the UK and Scotland in the long run.

Secondary Mitigation and Residual Effect

18-207. Emissions from the construction of the Project were predicted to be not significant. However, the Applicant is committed to reducing emissions during the construction phase where practicable.

18-208. The PAS 2080 guidance document highlighted in **Section 18.3.3** provides requirements to demonstrate leadership and establish effective governance mechanisms for reducing whole

[2] Carbon Leakage' refers to cases when eff emission reductions in one region or country leads to emissions to increase elsewhere, often due to industries relocating activities to countries with less stringent climate policies

life carbon in built environment projects. The following management measures may be considered as the Project develops, but are not required as additional mitigation:

- optimise the efficiency of construction activities to reduce fuel and material consumption and promote resource efficiency, inclusion of delivery and transport coordination requirements in the proposed Navigational Safety and Vessel Management Plan (Buchan Offshore Wind Ltd, 2025b), adoption of waste hierarchy in the pEMP (Buchan Offshore Wind Ltd, 2025a);
- explore opportunities to reduce embodied carbon and other construction emissions by developing carbon-focused procurement criteria and incentive mechanisms for material suppliers and project partners, such as low carbon and recycled materials, circular construction methods and performance benchmarking; and
- review and include PAS 2080's key principle and requirements with respect to carbon management in the relevant project documents which may include:
    - establish and communicate carbon management goals, roles and responsibilities, requirements and procedures to parties involved in the delivery of the Project;
    - practice the GHG mitigation hierarchy over the Project's lifetime;
    - set carbon reduction targets for the Project against a clear baseline which is aligned to the UK's and Scotland's net zero targets and develop the associated Key Performance Indicators and monitoring and reporting arrangements to keep track of the carbon performance of the Project;
    - promote collaboration and information sharing across the value chain to encourage whole life carbon reductions and continual improvement; and
    - provide training and raise awareness among the project team and partners on key carbon emission source and low carbon solutions.

18-209. The adoption of the mitigation above is not likely to reduce the magnitude of GHG emissions, and therefore the residual effect is Minor Adverse.

18.12.1.2 Operation and Maintenance Phase

18-210. The emission sources considered for the operation and maintenance phase of the Project are detailed in **Table 18-20** and include lifecycle modules B2, B3, B4, and D2. GHG emissions were quantified in accordance with the methodology outlined in **Section 18.9.2** and **Appendix 18.1: Greenhouse Gas Assessment Methodology**. As discussed in **Section 18.9.2.1**, there was limited activity data available for the Project to quantify emissions from the operation and maintenance phase. GHG emissions during the operation and maintenance phase are however likely to provide a smaller contribution of emissions compared to the other emission sources considered in the assessment, particularly those released during the construction phase.

18-211. Based on the Maximum Design Scenario outlined in **Section 18.10**, emissions predicted to be released during the operation and maintenance phase are shown in **Table 18-35** by lifecycle module and source group.

Table 18-35 Operation and Maintenance Phase GHG Emissions

Lifecycle Module	Source group	GHG emissions (tonnes CO_2e)	Percentage of operation and maintenance phase emissions for the Project
Proposed Offshore Development			
B2 – B4 (operation and maintenance)	Marine vessels (transit)	4,313	0.3%
	Marine vessel (on site)	11,400	1%
	Helicopter	27,066	2%
	Spare parts	35,867	2%
Proposed Offshore Development Sub-Total*		**78,646**	**5.2%**
Proposed Onshore Development			
B2 – B4 (operation and maintenance)	Road vehicles	86	<0.01%
Proposed Onshore Development Sub-Total*		**86**	<0.01%
Project Total		**78,732**	**5.2%**
Project Annual average		**2,249**	**0.1%**
*Over the 35 year operation and maintenance phase of the Project			

18-212. Emissions during the operation and maintenance phase of the Project are estimated to be 78,732 tonnes CO_2e over its 35-year operational life and on average 2,249 tonnes CO_2e per year. Emissions from spare parts are likely to be the largest source of emissions during the operation and maintenance phase. Although this has been derived from an assumption from literature, rather than a specific Project calculation; the majority of emissions associated with this category is likely to be derived from embodied carbon in materials. Most spare parts are likely to be implemented in the future (i.e. in over ten years), where it is expected that many sectors in the UK will have decarbonised to some extent. The Proposed Onshore Development is not anticipated to require the replacement of any electrical component during its operational life. Therefore, it is likely that emissions from spare parts for the Project would be less than the 35,864 tonnes CO_2e predicted in this assessment.

Operational GHG Intensity and Emissions Savings

18-213. The electricity generated by the Project is less GHG intensive than other forms of electricity generation such as gas or alternative fossil fuel sources, leading to avoided GHG emissions and thus savings compared to the defined 'Do Nothing' scenario over its operational lifetime. This is discussed further in **Section 18.12.1.4** which considers the whole lifecycle emissions of the Project.

18-214. GHG emissions that would have been produced under the 'Do Nothing' scenario were compared to those predicted to be released in the operation and maintenance phase of the Project, as presented in **Table 18-36.**

Table 18-36 GHG Emissions Saved During the Operation and Maintenance Phase

Lifecycle Module	Operation and maintenance GHG emissions (tonnes CO_2e)	GHG emissions from 'Do Nothing' scenario (tonnes CO_2e)	GHG emissions avoided (tonnes CO_2e)
D2 (operation and maintenance)	78,732	2,949,848	2,871,117

18-215. Based on the assumption that electricity generated by the Project displaces electricity generated from a gas-fired power station equipped with CCS, approximately 2.87 million tonnes CO_2e would be avoided during the operation and maintenance phase. It should be noted that the units for the emission factor for natural gas generation is CO_2 rather than CO_2e. However, the avoided GHG emissions are still considered to be representative, as the majority of GHG emissions from fossil fuel combustion is from CO_2. This comparison is based on a precautionary assumption that all gas-fired power stations operating in the UK over the operational and maintenance phase of the Project would have a 95% carbon capture rate.

18-216. The GHG intensity of the Project during the operation and maintenance phase is 0.55 g CO_2e /kWh. This was calculated using the predicted operation and maintenance phase GHG emissions, 78,732 tonnes CO_2e, and the total electricity that is forecast to be generated (142,504,740 MWh) as detailed in **Section 18.7.1.1**

Comparison to UK and Scotland's Carbon Budgets

18-217. The full operation and maintenance phase of the Project is anticipated to commence in 2035, with an operational lifetime of 35 years. Therefore, the initial operational year will fall within the UK's 6th Carbon Budget period (2033 to 2037) and the subsequent five operational years will fall within the UK's 7th Carbon Budget period (2038-2042). Emissions that would be released from operation and maintenance activities over these periods would account for 0.0007% of the UK's 6th Carbon Budget and 0.0021% of the UK's 7th Carbon Budget. As the subsequent UK Carbon Budgets are currently unknown, further consideration of the contribution of operation and maintenance phase emissions to UK Carbon Budgets cannot be undertaken. However, the magnitude of emissions over the Project's lifetime is anticipated to be a negligible contribution to future UK Carbon Budgets.

18-218. With consideration of Scotland's recommended Carbon Budgets, the first ten years of operation and maintenance phase fall within the 3rd (2036 to 2040) and (2041 to 2045) 4th Carbon Budget periods. GHG emissions released from operational and maintenance activities over these periods would account for 0.01% and 0.05% of Scotland's recommended 3rd and 4th Carbon Budgets, respectively, which also represents a relatively small proportion of the Carbon Budget.

18-219. In addition, as shown in **Table 18-35,** when considering the emissions saved by the Project from the provision of renewable energy to the NETS, the Project would result in avoided emissions when compared to the 'Do Nothing' scenario detailed in **Section 18.7.1.1.**

Significance of Effect

18-220. The Project would contribute to the UK meeting the projected increase in electricity demand resulting from population and economic growth (BEIS, 2022) and support the UK's decarbonisation aims through provision of renewable energy. Given the low GHG intensity of electricity generation, and the level of predicted emission savings, the significance of effect of the Project on GHG emissions during the operation and maintenance phase is considered to be Beneficial, which is Significant Effect in EIA terms. Any operation and maintenance emissions released by the Project over its lifetime would be Negligible and offset by the avoided emissions it enables.

Secondary Mitigation and Residual Effect

18-221. No additional mitigation is required beyond the embedded mitigation measures detailed in **Section 18.11**. Therefore, the residual effect remains Beneficial, which is a Significant Effect in EIA terms.

18.12.1.3 Decommissioning Phase

18-222. **Volume 1, Chapter 4: Project Description** presents a general approach to decommissioning for the Project. A Decommissioning Programme for the Proposed Offshore Development will be developed and submitted to MD-LOT prior to decommissioning taking place. A Decommissioning Plan for the Proposed Onshore Development, which is subject to a separate onshore planning application to be submitted to Aberdeenshire Council, will be developed prior to decommissioning taking place.

18-223. The detailed decommissioning strategy for the Project is not known at this stage, and therefore a specific quantification of emissions during this phase cannot be undertaken. Emission sources during decommissioning are likely to include marine vessels, the disassembly of offshore infrastructure and transport to its end-of-life destination, and those associated with waste processing, recycling and disposal.

18-224. Using an industry benchmark obtained from literature (Thomson & Harrison, 2015), decommissioning emissions from the Project are estimated to be 18,148 tonnes CO_2e, which equates to 1.2% of emissions released during the construction, and operation and maintenance phases.

18-225. It is anticipated that a large proportion of wind farm components would be recycled, repurposed or incinerated for energy recovery at the end-of-life stage, rather than sent to landfill, with current estimates for wind turbines recyclability ranging from 85 to 90% (Schmid *et al*., 2020). There are developing approaches and technologies for decommissioning of offshore wind farms, which could result in a lower GHG footprint than currently anticipated (Spyroudi *et al*., 2021). Furthermore, decommissioning emissions based on current assumptions are likely to be an overestimate, as it is likely a number of sectors will experience decarbonisation over the lifecycle of the Project. For example, 2045 and 2050 are target years for net zero emissions in Scotland and the UK's respectively (refer to **Volume 1, Chapter 2: Legislation and Policy**), therefore new end of life strategies are likely to become commercially available which would result in less emissions than equivalent activities undertaken in the present day. However, the figures for expected contribution of emissions in the decommissioning phase from studies of existing wind farms was used in the assessment. This is a proportion of emissions from the whole project, which in the assessment were calculated for the construction and operational and maintenance phases based on the emissions intensity of present day activities.

Significance of Effect

18-226. Decommissioning would result in a single occurrence of GHG emissions and is an inherent process in the lifecycle of offshore wind projects. The UK economy is likely to decarbonise over the lifespan of the Project, and therefore emission estimates based on present day activities are likely to result in an overestimation. Therefore, decommissioning emissions from the Project are considered to have a Minor Adverse effect on climate change, which is Not Significant in EIA terms. Similar to construction, decommissioning activities are expected to comply with applicable policy requirements and good practice design standards for offshore windfarms and onshore components at the time of its occurrence.

Secondary Mitigation and Residual Effect

18-227. Based on the available information on future decommissioning plans, no additional mitigation is required beyond the embedded mitigation measures detailed in **Table 18-32.** The residual effects remain as Minor Adverse**,** which is Not Significant in EI terms**.**

18.12.1.4 Whole Lifecycle Assessment

18-228. GHG emissions associated with the whole lifecycle of the Project are presented in Table 18-37.

Table 18-37 Whole Lifecycle GHG Emissions for the Project

Phase	Lifecycle module	GHG emissions (tonnes CO_2e)	Percentage of whole lifecycle emissions
Proposed Offshore Development			
Construction	A0 (pre-construction), A1 – A3 (embodied carbon), A4 (transportation to site) and A5 (construction)	890,785	58.9%
Operation and maintenance	B2 – B4 (operation and maintenance)	78,646	5.2%
Proposed Offshore Development total (excluding decommissioning)		**969,430**	
Proposed Onshore Development			
Construction	A0 (pre-construction), A1 – A3 (embodied carbon), A4 (transportation to site) and A5 (construction)	524,186	34.7%
Operation and maintenance	B2 – B4 (operation and maintenance)	86	<0.01%
Proposed Onshore Development total (excluding decommissioning)		**524,272**	
Project Decommissioning	**C1- C4 (Decommissioning)**	**18,148**	1.2%
Project Whole Lifecycle Total		**1,511,851**	

18-229. GHG emissions released across the whole lifecycle of the Project were estimated to be 1,511,851 tonnes CO_2e. Emissions during the construction phase of the Project contributed the largest proportion to lifecycle emissions, accounting for 93.6% of the total.

Impact 1 Overall GHG Intensity

18-230. The overall GHG intensity of electricity generated by the Proposed Offshore Development was estimated to be 10.5 g CO_2e per kWh. This compares favourably with other forms of fossil fuel electricity generation (CCC, 2013; Net Zero Teesside Power Limited, 2021), as listed below:

- unabated Combined Cycle Gas Turbine: 380 to 50 g CO_2e per kWh; and
- gas with CCS: 20 to 245 g CO_2e per kWh.

Overall Significance of Effect

18-231. As the Project would enable the provision of renewable energy to the UK NETS and contribute positively to Scotland and the UK's progress in meeting its net zero targets, the overall significance of effect is considered to be Beneficial, which is Significant in EIA terms.

Secondary Mitigation and Residual Effects

18-232. No additional mitigation is required beyond the embedded mitigation measures detailed in **Section 18.11**. Therefore, the residual effect remains Beneficial, which is Significant in EIA terms.

18.12.2 Impact 2 Blue Carbon Assessment

18.12.2.1 Construction Phase

Benthic Habitats

18-233. As discussed in **Section 18.7.2.2**, a total of 14 benthic habitats were identified within the Proposed Offshore Development Site; five of which are recognised Blue Carbon habitats. These habitats, listed in **Table 18-9**, are evaluated below for the potential to be impacted by construction activities associated with the Proposed Offshore Development. These include:

- *Sabellaria (spinulosa)* reefs (CR.MCR.CSab.Sspi.ByB);
- *Sabellaria (spinulosa)* reefs (SS.SBR.PoR.SspiMx);
- Brittlestars (MCR.EcCr.FaAlCr.Bri);
- Bryozoan thickets, *Flustra foliacea (*CR.MCR.EcCr.FaAlCr.Flu); and
- Kelp and red seaweeds.

Receptor Sensitivity

18-234. *Sabellaria* (*spinulosa*) reefs (CR.MCR.CSab.Sspi.ByB and SS.SBR.PoR.SspiMx) are found within water depths of 0 m to 50 m (MarLIN, 2024a) (MarLIN, 2024b); therefore, they will only be affected by export cable installation activities related to seabed preparation and remedial protection placement on the approach to the Landfall Area. *Sabellaria* reefs are listed under the EC Habitats Directive Annex I (Reefs), Habitats of Principal Importance, Habitat of Conservation Interest, UK BAP Priority, and OSPAR Annex V.

18-235. *Sabellaria* reefs are unevenly distributed along the UK coast, and only a small proportion of this habitat occurs in Scotland. *Sabellaria* reefs are considered to be a high sensitivity receptor due to their sensitivity to physical changes, in particular physical pressures such as habitat loss, surface abrasion, subsurface disturbance, and heavy siltation rate changes (MarLIN, 2024a) (MarLIN, 2024b).

18-236. Brittlestar beds are found within water depths of 0 m to 50 m (MarLIN, 2024c); therefore, they will only be affected by the nearshore offshore export cable installation activities related to seabed preparation and remedial protection placement on the approach to the Landfall Area. Although brittlestar beds are not a PMF, the species itself is listed within multiple other priority habitat types. This habitat is also listed under the EC Habitats Directive Annex I (Reefs).

18-237. The CR.MCR.EcCr.FaAlCr.Bri biotope is characterised by dense brittlestar beds overlying a sparse grazed faunal turf. The rocky substratum of this variant is usually colonised by species such as encrusting red algae and the white, calcareous tubes of the polychaete *Spirobranchus triqueter*.

18-238. Brittlestar beds are unevenly distributed along the UK coast, and only a small proportion of this habitat occurs in Scotland and has the potential to be impacted by offshore export cable installation activities. Brittlestar beds are considered to be a high sensitivity receptor its sensitivity to physical changes (MarLIN, 2024c).

18-239. Bryozoan thickets (*Flustra foliacea*) are found within water depths of 0 m to 30 m (MarLIN, 2024d); therefore, if present, will only be affected by the nearshore offshore export cable installation activities related to seabed preparation and remedial protection placement on the approach to the Landfall Area. This habitat is also listed under the EC Habitats Directive Annex I (Reefs).

18-240. Bryozoan thickets are unevenly distributed along the UK coast, and only a small proportion of this habitat occurs in Scotland and has the potential to be impacted by offshore export cable installation activities. Bryozoans are fast-growing, self-regenerating fauna with limited larval dispersal. *Flustra foliacea* recovers rapidly within two years from most damage, but recovery may take longer if over 75% of the population is removed. Bryozoan thickets are therefore considered to be a medium sensitivity receptor (MarLIN, 2024d).

18-241. Kelp and red seaweeds are found within water depths of 0 m to 20 m (JNCC, 2024); therefore, they will only be affected by the nearshore offshore export cable installation activities related to seabed preparation and remedial protection placement on the approach to the Landfall Area. Kelp beds are a PMF, listed under the EC Habitats Directive Annex I (Reefs), Scottish Biodiversity List and UK BAP (Tyler-Walters *et al*., 2016). This habitat is also listed under the Bern Convention in a Resolution 4 habitat type at a higher level (A3).

18-242. Kelp beds are widely distributed along the UK coast, and therefore only a small proportion of this habitat will be impacted by offshore export cable installation activities. Kelp beds are considered to be a high sensitivity receptor.

18-243. The Blue Carbon habitats identified within the Proposed Offshore Development Site were identified to be of a high or medium sensitivity to potential activities associated with the Proposed Offshore Development.

Impact Magnitude

18-244. Due to the highly localised spatial extent of the activities, and the low frequency of cable construction / installation events, the magnitude of impacts from construction of Proposed Offshore Development is considered to be negligible. This is largely due to the limited time period that works will occur in any one location and sufficient circulation avoiding high levels of smothering of nearby habitats. Additionally, the embedded mitigation measures which are included in **Volume 1, Chapter 7: Benthic Intertidal Ecology** and are summarised in **Section 18.11**, will minimise any potential disturbance or damage. These measures include, but are not limited to, micro-siting to avoid sensitive habitats and reducing localised habitat loss. Impacts are unlikely to affect the long-term functioning of the identified Blue Carbon habitats.

Significance of Effect

18-245. Based on the impact assessment matrix in **Table 18-24**, the overall effect on Blue Carbon from habitat loss and disturbance is considered to be Minor, which is Not Significant in EIA terms.

Blue Carbon Loss

18-246. As discussed in **Section 18.7.2** the sediment types within the Proposed Offshore Development Site, and their respective OC and IC contents are evaluated below for the potential to be impacted by the proposed construction activities.

18-247. The exact mass of carbon released from sediment disturbance during construction activities has been estimated using existing survey data, as shown in **Table 18-38**. Utilising the data from Smeaton *et al.* (2021a), an estimate for the mass of both OC and IC within the surficial sediments (top 10 cm) of the Proposed Offshore Development Site was calculated by extracting GIS carbon data and overlaying within the Proposed Offshore Development Site boundaries. The data was then clipped, and the total IC and OC values summed to calculate the Blue Carbon stock in the Proposed Offshore Development Site. The potential release of Blue Carbon was then determined by applying the areas of seabed take (0.63%) for infrastructure associated with the Proposed Offshore Development, as shown in **Table 18-25**. The results of the assessment are presented in **Table 18-38**.

Table 18-38: Blue Carbon Loss from Sediment Disturbance

	Carbon within the Proposed Offshore Development Site (Tonnes)	Seabed Take (%)	Carbon Released from Disturbed Sediments (Tonnes)	CO_2e (Tonnes)
Mass	709,571	0.63	4,470	16,406*
*The carbon stock loss for OC and IC was combined, and multiplied by 44/12, which is a standard multiplier to convert carbon to CO_2e, where 12 is the atomic mass of carbon and 44 is the molecular mass of CO_2 .				

18-248. The assessment predicted that there could be 16,406 tonnes CO_2e released from the disturbance of sediment associated with construction of the Proposed Offshore Development. Due to the conservative assumptions adopted (i.e. assuming surficial sediments across the whole Proposed Offshore Development Site are liberated) and the uncertainty around the ultimate repository of the emitted Blue Carbon, the overall effect on Blue Carbon from sediment disturbance is considered to be Negligible, which is Not Significant in EIA terms. Therefore, the Proposed Offshore Development is unlikely to affect the long-term function of these sediments.

18.12.2.2 Operation and Maintenance Phase

18-249. During operation and maintenance, routine activities may cause some disturbance to benthic habitats and sediments, potentially releasing stored Blue Carbon. However, activities that would impact sediments and Blue Carbon habitats are largely limited when compared to the construction phase. Therefore, the emissions of Blue Carbon during the operation and maintenance phase are predicted to be lower than those from the construction phase.

18-250. Activities associated with the Proposed Offshore Development are unlikely to have an impact on the carbon sequestration potential of the immediate seabed and associated habitats. As such, in accordance with the impacts assessed on benthic habitats in **Volume 1, Chapter 7: Benthic Intertidal Ecology**, the magnitude of impact on Blue Carbon is assessed to be Negligible during the operation and maintenance phase, which is Not Significant in EIA terms.

18.12.2.3 Decommissioning Phase

18-251. The decommissioning phase will involve the dismantling and removal of the Proposed Offshore Development . This process has been planned to utilise advanced techniques and equipment that reduce GHG emissions. The potential for the release of Blue Carbon during decommissioning is expected to be lower than during the construction phase, as the process will be more streamlined and less resource-intensive. However, the removal of structures may disturb benthic habitats and sediments, leading to the release of stored Blue Carbon. Careful planning and execution of decommissioning activities will aim to reduce these disturbances and support the restoration of marine habitats, thereby promoting the re-sequestration of Blue Carbon.

18-252. At the time of writing, it is anticipated that all Proposed Offshore Development infrastructure will be removed, as per regulatory guidance. However, it is acknowledged that this plan may be updated in the future. The methodology and decommissioning plan will be updated to reflect this and industry best practice at the time of decommissioning. **Volume 1, Chapter 4: Project Description** presents further detail on decommissioning methodology.

18-253. Activities associated with the Proposed Offshore Development are unlikely to have an impact on the carbon sequestration potential of the immediate seabed and associated habitats. As such, in accordance with the impacts assessed on benthic habitats in **Volume 1, Chapter 7: Benthic Intertidal Ecology**, the magnitude of impact on Blue Carbon is considered to be Negligible during decommissioning of the Proposed Offshore Development, which is Not Significant in EIA terms.

18.12.3 Impact 3 CCR Assessment

18.12.3.1 Step 1: Identifying Receptors, Climate Variables and Hazards

18-254. As identified in **Sections 18.7.3.1** to **18.7.3.6,** the main climate variables which could be affected by climate change in the Study Area are temperature, precipitation, wind speeds, extreme weather events and sea level rise.

18-255. The climate hazards with potential to impact the project are summarised in Table 18-39.

Table 18-39: Climate Hazards Relevant to the Project

Climate variable	Hazard
Extreme high temperatures	Increased frequency and severity of heatwaves
Average temperature increase	Increase in average air temperature
	Increase in average sea temperature
Extreme low temperatures	Change in frequency of ice conditions
	Change in frequency and quantity of snowfall
Extreme Precipitation	Increase in frequency and intensity of extreme precipitation events
Reduced average precipitation	Increased frequency and severity of drought conditions

Climate variable	Hazard
Sea level rise	Tidal flooding
	Increased tidal range
	Increased coastal erosion
Extreme storms	Increase in extreme wave height
	Increase in frequency and intensity of storm conditions (peak gust speed, average wind speed, storm duration)
	Change in storm patterns, e.g. wind direction
	Change in frequency of lightning events

18-256. The Proposed Offshore Development may be exposed to a range of climate hazards, defined as extreme weather events and chronic climatic changes with the potential to harm human, environmental or infrastructure receptors (IEMA, 2020). Exposure to climate hazards may lead to impacts on the Proposed Offshore Development such as physical damage to infrastructure components or adverse working conditions during construction, operation and maintenance and decommissioning activities.

18-257. The receptors identified that may be vulnerable to the projected effect of climate change during the construction, operation and maintenance and decommissioning phases of the Proposed Offshore Development are listed in Table 18-40.

Table 18-40: Climate Change Resilience Receptors

Receptor Type	Receptor	Phase
Human Health	Site workers	Construction Decommissioning
Buildings & Infrastructure	Temporary platforms Jack-up rigs	Construction Decommissioning
	Landfall Area Cables (array, inter-platform, export) Floating foundations IRC Platform WTG OSP Mooring systems and anchors	Construction Operation and maintenance Decommissioning

18-258. The decommissioning phase is considered in this CCR assessment based on details in the Decommissioning Plan, and the assumption that the receptors would be the same as in the construction phase.

18-259. The vulnerability and resilience of the Proposed Offshore Development's receptors to these climate parameters are considered in Step 2 of the CCR assessment. The receptors, climate variables and hazards taken forward in Step 2 are set out in **Table 18-41**.

Table 18-41 Receptors, Climate Variables and Climate Hazards for the Proposed Offshore Development

Climate Variable	Potential Climate Hazards			Receptors affected
	Construction Phase	**Operation and Maintenance Phase**	**Decommissioning Phase**	
Temperature	Heatwave – For the construction phase, the present-day climate information presented in **Section 18.7.3.1** and the trends indicated by **Table 18-16** and **Table 18-17** suggest that annual temperatures in the Study Area may be rising, particularly during summer months. However, temperatures during the construction phase are expected to be similar to the present climate.	Heatwave – For the operation and maintenance phase (2040s to 2060s), the data in **Table 18-16** and **Table 18-17** shows that annual temperatures in the Study Area are predicted to rise, particularly during summer months. Mean annual temperatures are projected to increase by 0.2-2.6°C (RCP4.5, 10th percentile to RCP8.5, 90th percentile), compared to the 1981-2000 baseline. Maximum summer temperatures are projected to change within the range of -0.3 to 3.4°C (RCP4.5, 10th percentile to RCP8.5, 90th percentile). This may result in more periods of extreme high temperatures or heatwaves which could affect maintenance and operation.	Heatwave - For the decommissioning phase (2070s), the data in **Table 18-16** and **Table 18-17** shows that annual temperatures in the Study Area are predicted to rise, particularly during summer months. Mean annual temperatures are projected to increase by 0.4-3.1°C (RCP4.5, 10th percentile to RCP8.5, 90th percentile) compared to the 1981-2000 baseline. Maximum summer temperatures are projected to increase by 0.1-4.2°C (RCP4.5, 10th percentile to RCP8.5, 90th percentile). This may result in more periods of extreme high temperatures or heatwaves which could affect decommissioning operations.	Site workers IRC platform WTGs OSP
	Increased water temperature – The present-day and historic climate information presented in **Section 18.7.3** indicates that sea temperatures are increasing. However, temperatures during the construction phase are expected to be similar to the present climate.	Increased water temperature – Climate projection data is not available for sea temperatures. The present-day and historic climate information presented in **Section 18.7.3** shows that sea temperatures are increasing and are expected to continue to increase. An increase in marine heat waves is also predicted. If the average rate of warming of 0.3°C per decade continues, sea surface temperatures could increase by 1.5°C by the 2060s.	Increased water temperature – Climate projection data is not available for sea temperatures. The present-day and historic climate information presented in **Section 18.7.3** shows that sea temperatures are increasing and are expected to continue to increase. An increase in marine heat waves is also predicted. If the average rate of warming of 0.3°C per decade continues, sea surface temperatures could increase by 1.8°C by the 2070s.	IRC Platform WTGs OSP
	Snow and Ice – The present-day climate information and the trends in the future climate show that annual temperatures in the Study Area are rising, and that the frequency of snow and ice conditions may decrease in future. However, temperatures during the construction phase are expected to be similar to the present climate, so snow and ice would still be expected to occur during the construction period.	Snow and Ice - the climate projection data in **Table 18-16** and **Table 18-17** shows that for the operation and maintenance phase, the average winter temperatures in the Study Area are predicted to change within the range of -0.1 to 2.8°C (RCP4.5, 10th percentile to RCP8.5, 90th percentile). Whilst potential impacts associated with snow and ice conditions could decrease, snow and ice would still be expected to occur during the operation and maintenance phase.	Snow and Ice - the climate projection data in **Table 18-16** and **Table 18-17** shows that for the decommissioning phase, the average winter temperatures in the Study Area are predicted to increase by up to 3.2°C (RCP8.5, 90th percentile). Whilst potential impacts associated with snow and ice conditions could decrease, snow and ice would still be expected to occur during the decommissioning phase.	Site workers IRC platform WTGs OSP
Precipitation	Rainfall – the present-day climate information (**Section 18.7.3.1**) and the trends in the future climate (**Table 18-16** and **Table 18-17**) show that annual precipitation in the Study Area during the construction phase is expected to be variable and similar to the present climate. This could disrupt construction operations, particularly in winter.	Rainfall – the climate projection data in **Table 18-16** and **Table 18-17** show that precipitation rates in the Study Area during the operation and maintenance phase are expected to continue to be variable. There is projected to be an increase in precipitation during winter months with a maximum projected increase of 46.9% (RCP8.5, 90th percentile), which could lead to more frequent disruption to operations due to extreme rainfall during this season.	Rainfall – the climate projection data in **Table 18-16** and **Table 18-17** show that precipitation rates in the Study Area during the decommissioning phase are expected to continue to be variable. An increase in precipitation is projected in winter with a maximum projected increase of 53.1% (RCP8.5, 90th percentile), which could result in disruption to decommissioning operations due to extreme rainfall.	Site workers IRC platform WTGs OSP

Climate Variable	Potential Climate Hazards			Receptors affected
	Construction Phase	**Operation and Maintenance Phase**	**Decommissioning Phase**	
	Drought – the present-day climate information (**Section 18.7.3.1**) and the future climate trends (**Table 18-16 and Table 18-17**) show that annual precipitation in the Study Area during construction is expected to be variable and similar to the present climate. In the present climate, drought events can occur during summer months and therefore could occur during the construction phase.	Drought – the RCP8.5 climate projection data in **Table 18-16 and Table 18-17** show that annual precipitation levels in the Study Area for the operation and maintenance phase are variable and likely to be similar to the present climate. However, there is projected to be less precipitation during summer months, with a maximum projected decrease of -27.5% (RCP8.5, 10th percentile) demonstrating that there could be drought events during the summer.	Drought – the RCP8.5 climate projection data in **Table 18-16 and Table 18-17** show that annual precipitation levels in the Study Area for the operation and maintenance phase are variable and likely to be similar to the present climate. However, there is projected to be less precipitation during summer months, with a maximum projected decrease of -32.1% (RCP8.5, 10th percentile) demonstrating that there could be drought events.	Site workers Landfall Area
Sea level rise	Tidal flooding, Coastal erosion – during the construction phase, sea levels are not expected to rise by more than 0.20 m compared to the 1981-2000 baseline, therefore tidal conditions and the associated risk of tidal flooding and coastal erosion at the Landfall Area are expected to be similar to the present day.	Tidal flooding, Coastal erosion - sea levels are likely to rise in the operation and maintenance phase by between 0.15 and 0.39m (RCP4.5, 10th percentile to RCP8.5, 90th percentile). This may increase the risk of tidal flooding and coastal erosion and affect receptors in coastal areas such as the Landfall Area and could disrupt access to the offshore platforms for maintenance.	Tidal flooding, Coastal erosion - sea levels are likely to be up to 0.5m higher in the decommissioning phase compared to the 1981-2000 baseline (RCP8.5, 90th percentile). This may increase the risk of tidal flooding and coastal erosion at the Landfall Area and could disrupt access to the offshore platforms for decommissioning works.	Landfall Area IRC platform WTGs OSP
Extreme weather events	Storm events - although there is uncertainty as to the degree that climate change would affect extreme weather events, recent evidence suggests that storms are becoming more frequent and intense. High winds and extreme precipitation during extreme storms can result in flooding which could affect the Landfall Area as discussed above. Turbulent waves, strong undercurrents and storm surges also occur during storms (Palmer *et al.* 2018) which could disrupt construction, operation and maintenance and decommissioning operations and result in safety impacts for workers. The offshore infrastructure will be designed to allow for future conditions offshore.			Site workers Landfall Area IRC platform WTGs OSP

18.12.3.2 Step 2: Climate Vulnerability Assessment

Climate Vulnerability Assessment – Construction Phase

18-260. As the construction phase of the Proposed Offshore Development is likely to be complete to enable full operation by 2035, a high level vulnerability assessment was undertaken for the construction phase based on the present-day climate baseline (see **Section 18.7.3.1**) and known trends in the future climate.

18-261. The vulnerability of the identified receptors to each of the climate hazards presented in **Table 18-41** is assessed in **Table 18-42** for the construction phase of the Proposed Offshore Development.

18-262. The degree of climatic change during the construction of the Proposed Offshore Development is not likely to result in significant changes from present day conditions, and best practice mitigation measures will be applied. Therefore, the receptors for the construction phase of the Proposed Offshore Development (**Table** 18-40) are considered to have low or medium exposure, and a low sensitivity to climate change hazards during this phase. Based on the criteria identified in **Section 18.9.4**, the identified receptors are assessed to have low vulnerability to climate change.

18-263. This is evident from **Table 18-40**, where in the construction phase, the potential climate hazards from temperature, precipitation and sea level rise are expected to be similar to the present-day conditions. The environmental and management plans for the construction period will take account of these weather changes which do not pose any significant risks construction of the Proposed Offshore Development.

18-264. Therefore, the climate change impacts during construction are all considered to be Not Significant. A more detailed assessment of the risks for this phase of the Proposed Offshore Development is not required in Step 3 and Step 4.

Climate Vulnerability Assessment – Operation and Maintenance Phase

18-265. In terms of the operation and maintenance phase of the Proposed Offshore Development, this section should be read in conjunction with the major accidents and disasters screening presented in **Volume 1, Chapter 14: Major Accidents and Disasters**.

18-266. The vulnerability of the identified receptors (**Table** 18-40) to each of the climate hazards (**Table 18-41**) is assessed in **Table 18-43** for the operation and maintenance phase of the Proposed Offshore Development.

18-267. As discussed in **Volume 1, Chapter 6: Marine and Coastal Physical Processes,** the Landfall Area is located in an area which has historically been sensitive to coastal erosion. Coastal defences have been installed across the region to address this risk.

18-268. Sea level rise is not expected to significantly increase the risk of coastal erosion at the Landfall Area during the operation and maintenance phase. It is also assumed that the Landfall Area is not sensitive to tidal flooding, and that this sensitivity will not increase with sea level rise.

18-269. As noted in **Section 18.7.3.7**, the UK is projected to be warmer across all seasons. The offshore infrastructure will be constructed using best practice building materials and techniques to provide sufficient thermal protection to mitigate the risks from increased high temperatures, including overheating of mechanical and electrical assets. In addition, the offshore cables will be afforded thermal insulation by the water column or the seabed. The receptors considered to be sensitive to increasing air or sea temperatures and heatwaves are considered to have low exposure and a low sensitivity during the operation and maintenance phase, due to the embedded mitigation included as part of the design. Therefore, these receptors are assessed as having a low vulnerability to climate change.

18-270. As detailed in **Section 18.7.3.7**, there is uncertainty as to the degree that climate change would affect extreme weather events. Winter windstorms may increase slightly in number and intensity over the UK, although this has medium confidence at present due to varying model predictions (Met Office, 2025).

18-271. The Proposed Offshore Development has been designed to have an inherent level of resilience to mitigate the risk of storm events affecting receptors during the operation and maintenance phase. Offshore structures, cables and cable protection will be designed in line with applicable codes, standards and industry best practice to account for potential future changes to the seabed due to sediment transport. Maintenance plans, including the Environmental Management Plan (see **Section 18.11**) will consider the exposure of maintenance workers and plant to extreme weather events and ensure appropriate preparation and response measures are in place to minimise their impacts.

18-272. The UK Climate Change Risk Assessment (CCRA3) (HM Government, 2022) highlights the risk to infrastructure from cascade effects. Climate change could cause impacts on the Proposed Offshore Development which affect the wider energy transmission network. Similarly, climate change impacts on the wider network could affect the Proposed Offshore Development infrastructure. Maintenance plans, including the Inspection and Maintenance Programme, should address the risk of failure of the infrastructure and consider the possibility that failure could have wider impacts.

18-273. In general, the receptors for the operations and maintenance phase of the Proposed Offshore Development are considered to have moderate exposure and a low sensitivity to climate change impacts on extreme weather events, resulting in an assessment of low vulnerability for most risks. However, even with the embedded mitigation, there remains the risk that successive storm events could occur within a relatively short timeframe, which could prevent maintenance for an extended period, leading to prolonged downtime or increasing the risk or severity of damage to infrastructure. The Project is therefore considered to have a moderate exposure and a moderate sensitivity to successive storm events, and as such has a medium vulnerability. The further assessment of this risk is set out in **Section 18.12.3.3**.

Climate Vulnerability Assessment – Decommissioning Phase

18-274. The vulnerability of the identified receptors to each of the climate hazards presented in **Table 18-41** is assessed in **Table 18-44** for the decommissioning phase of the Proposed Offshore Development.

18-275. The decommissioning scenarios for the Proposed Offshore Development are described in **Volume 1, Chapter 4: Project Description**. Decommissioning arrangements for the offshore components would be confirmed in a Decommissioning Programme prior to construction, and it is expected that a detailed CCR assessment for decommissioning will be performed as part of this plan, with suitable mitigation measures adopted to reduce the risk to the Proposed Offshore Development.

18-276. The CCR assessment has been completed for the decommissioning phase based on the aims outlined in **Volume 1, Chapter 4: Project Description**, and the assumptions that the decommissioning receptors will be equivalent to the construction receptors outlined in **Table 18-40**, and that the decommissioning phase would be of a similar duration to the construction phase. This is likely to be an overestimate, as future development of regulation and decommissioning methodologies may result in alternative approaches being implemented.

18-277. The degree of climatic change by the 2070s means that the sensitivity of the receptors to climate change impacts during the decommissioning phase has been assessed as moderate for those impacts which could delay decommissioning operations. Based on the criteria identified in **Section 18.9.4**, some receptors are assessed to have medium vulnerability to the climate change impacts of heatwave and increased frequency of storm events. The further assessment of climate impacts during decommissioning is set out in **Section 18.12.3.3**.

Table 18-42: Vulnerability assessment – Construction Phase

Climate trend	Impact	Embedded mitigation measures	Receptor	Sensitivity	Exposure	Vulnerability	Significance
Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Increased heat stress or heat exhaustion experienced by the construction workforce.	Construction management plans	Site workers	Moderate	Low	Low vulnerability	Not significant
	Restriction of certain construction activities during hot weather, e.g. grouting undertaken in higher temperatures could reduce the strength and durability of the finished product. This could cause programme delay.		IRC platform Installation Vessels Landfall Area OSP WTG	Low	Low	Low vulnerability	Not significant
Increased frequency and intensity of storm events and wave heights	Extreme storminess resulting in unsafe working environments and causing delays to construction programme.	Construction management plans	Site workers	Moderate	Low	Low vulnerability	Not significant
	Increased risk of disruption to construction work, such as cranes / barges / rigs unable to operate in high winds.		IRC platform Installation Vessels Landfall Area OSP WTG	Moderate	Low	Low vulnerability	Not significant

Table 18-43: Vulnerability assessment – Operation and Maintenance Phase

Climate trend	Impact	Embedded mitigation measures	Receptor	Exposure	Sensitivity	Vulnerability	Significance
Increased frequency and intensity of storm events and wave heights.	Increased loading resulting in destabilisation or degradation of WTGs, mechanical systems and structures.	Design of the Proposed Offshore Development	WTG	Low	Low	Low Vulnerability	Not significant
	Sediment transport across seabed during high energy storms leading to loss of integrity of foundations or cabling systems from scour and exposure.	Design of the Proposed Offshore Development	IRC platform OSP Cables (array, inter-platform, export)	Low	Low	Low Vulnerability	Not significant
	Lightning causing physical damage, fire, or power surge to turbines or offshore substations.	Design of the Proposed Offshore Development	WTG OSP	Moderate	Low	Low Vulnerability	Not significant
	Extreme storminess resulting in unsafe working environments and causing delays to maintenance programme.	Maintenance Plans	Site workers	Moderate	Low	Low vulnerability	Not significant
	Extreme storminess impeding access for maintenance and inspection resulting in downtime. Potentially resulting in significant damage and/or extended operational downtime if repeated storm events prevent access for an extended period of time.	Maintenance Plans	Wind turbines IRC Platform OSP	Moderate	Moderate	Medium vulnerability	Assessed in Step 3 and Step 4
Increased annual mean temperatures, especially in summer. Increase in frequency and intensity of hot spells.	Overheating of M&E assets such as turbines and offshore substations, leading to a decrease in asset performance and rating and/or requiring additional electricity demand for mechanical cooling units.	Design of the Proposed Offshore Development	WTG OSP	Moderate	Low	Low vulnerability	Not significant
Low temperatures and cold snaps could still occur.	Cold weather leading to ice accretion affecting the efficiency and performance of turbines.	Design of the Proposed Offshore Development	WTG OSP	Low	Low	Low Vulnerability	Not significant
Increasing sea surface temperatures and ocean acidification.	Increased corrosion of the structures, increasing the risk of failure.	Design of the Proposed Offshore Development	WTG IRC platform OSP	Low	Low	Low Vulnerability	Not significant
Sea level rise.	Risk to the landfall from coastal flooding and erosion.	Design of the Proposed Offshore Development	Landfall Area	Low	Low	Low Vulnerability	Not significant
Cascade effects due to climate change impacts	Climate change impacts on the Proposed Offshore Development result in impacts on the wider electricity transmission network.	Maintenance Plans	Electricity transmission network	Low	Low	Low Vulnerability	Not significant
	Climate change impacts on the wider electricity transmission network result in impacts on the Proposed Offshore Development.	Maintenance Plans	Electricity transmission network	Low	Low	Low Vulnerability	Not significant

Table 18-44: Vulnerability assessment – Decommissioning Phase

Climate trend	Impact	Embedded mitigation measures	Receptor	Sensitivity	Exposure	Vulnerability	Significance
Increased annual mean temperatures, especially in summer, and an increase in the frequency and intensity of hot spells.	Increased heat stress or heat exhaustion experienced by the workforce.	Decommissioning plans	Decommissioning workers	Moderate	Low	Low vulnerability	Not significant
	Restriction of certain decommissioning activities during hot weather could cause programme delay.		Temporary platforms Vessels Landfall Area OSP WTG	Moderate	Moderate	Medium vulnerability	Assessed in Step 3 and Step 4
Increased frequency and intensity of storm events and wave heights	Extreme storminess resulting in unsafe working environments and causing delays to decommissioning programme.	Decommissioning plans	Decommissioning workers	Moderate	Low	Low vulnerability	Not significant
	Increased risk of disruption to decommissioning, such as cranes / barges / rigs unable to operate in high winds, causing programme delay.	Decommissioning plans	Temporary platforms Vessels Landfall Area OSP	Moderate	Moderate	Medium vulnerability	Assessed in Step 3 and Step 4

18.12.3.3 Steps 3 and 4: Climate Risk Assessment and Resilience Rating

18-278. For **Table 18-41**, **Table 18-42** and **Table 18-43**, the embedded mitigation measures have been referenced from **Section 18.11**. The Vulnerability has been set on based on a combination of Sensitivity and Exposure, as defined in **Table 18-25**. Receptors with Low Vulnerability are deemed to be Not Significant for further assessment in Steps 3 and 4.

18-279. The assessment of Climate Change Resilience Effects is set out below. The assessment includes those impacts for which receptors are considered to have medium or high vulnerability, as shown in **Table 18-41, Table 18-42 and Table 18-43.** These impacts included:

- storm events during the operational and maintenance phase; and
- storm events and heatwaves during the decommissioning phase.

18-280. As set out in **Section 18.9.4.3**, the risks to the Proposed Offshore Development following the implementation of embedded mitigation measures were qualitatively identified using a hazard likelihood and consequence matrix (Step 3), and a resilience rating was then determined (Step 4). The overall significance of the CCR assessment was established for each climate change impact based on the assessment of the residual risk and the resilience rating, using the matrix provided in **Section 18.9.4.5**. The outcomes of the risk assessment are provided in **Table 18-45.**

Table 18-45: Assessment of Likely Significant Effects

Climate trend	Impact	Receptor	Proposed mitigation measures	Likelihood of Impact	Consequence of Impact	Significance
Operation and Maintenance Phase						
Increased frequency and intensity of storm events and wave heights.	Extreme storminess impeding access for inspection and maintenance resulting in downtime. Potentially resulting in significant damage and/or extended operational downtime if repeated storm events prevent access for an extended period of time.	WTGs OSPs Offshore substations	Maintenance Plans will be prepared and implemented as discussed in **Section 18.11**, informed by monitoring of weather conditions. Maintenance Plans should consider the risk of prolonged delays to maintenance due to extreme weather events. Further mitigation in addition to the embedded measures would not change the likelihood or consequence.	Moderate	Minor	**Low (Not Significant)**
Decommissioning Phase						
Increased annual mean temperatures, especially in summer, and an increase in the frequency and intensity of hot spells.	Restriction of certain decommissioning activities during hot weather could cause programme delay.	Temporary platforms Jack-up rigs Landfall Area WTGs OSPs	Decommissioning Plans will be prepared and implemented as discussed in **Section 18.11**, informed by monitoring of weather conditions. Further mitigation in addition to the embedded measures would not change the likelihood or consequence.	Moderate	Minor	**Low (Not Significant)**
Increased frequency and intensity of storm events and wave heights.	Increased risk of disruption to decommissioning, such as cranes / barges / rigs unable to operate in high winds, causing programme delay.	Temporary platforms Jack-up rigs Landfall Area WTGs OSPs	Decommissioning Plans will be prepared and implemented as discussed in **Section 18.11**, informed by monitoring of weather conditions. Further mitigation in addition to the embedded measures would not change the likelihood or consequence.	Moderate	Minor	**Low (Not Significant)**

18-281. The risk assessment provided in **Table 18-45** demonstrates that there is a moderate likelihood of climate change impacts associated with extreme storm events adversely affecting the Proposed Offshore Development during the operation and maintenance phase, and increasing temperatures and extreme storm events adversely affecting the Proposed Offshore Development during the decommissioning phase. The consequence of the impact is assessed to be Minor and no additional (secondary) mitigation measures are required. The Project is assessed as having a High resilience rating in relation to this risk. Any effects of climate change on the Proposed Offshore Development during the decommissioning phase are considered to be Not Significant in EIA terms.

18.12.4 Impact 4 Proposed Monitoring

18-282. The Proposed Offshore Development is not anticipated to require any specific monitoring with respect to GHG emissions and climate change resilience.

18.13 CUMULATIVE EFFECTS ASSESSMENT

18.13.1 Impact 1 GHG Assessment

18-283. The global atmosphere is the receptor for the GHG assessment. Emissions of GHGs to the atmosphere have the potential to contribute to climate change, and therefore the effects are global and cumulative in nature. This is considered in defining the receptor (i.e., the global atmosphere) as high sensitivity.

18-284. The IEMA guidance (IEMA, 2022) states that effects of GHG emissions from specific cumulative projects should therefore not be individually assessed, as there is no basis for selecting which projects to assess cumulatively over any other. The GHG assessment considered the Project as whole, including the Proposed Offshore Development and Proposed Onshore Development, therefore no additional consideration of cumulative effects is required.

18.13.2 Impact 2 Blue Carbon Assessment

18-285. **Volume 1, Chapter 7: Benthic and Intertidal Ecology** outlines external projects that could potentially impact benthic ecology receptors within the Proposed Offshore Development Site, resulting in cumulative impacts on the identified Blue Carbon benthic habitats due to habitat loss or disturbance from subsea infrastructure placement. **Section 7.13.1** of **Volume 1, Chapter 7: Benthic and Intertidal Ecology** highlights the following projects which have potential or assumed temporal overlap with construction phase of the Proposed Offshore Development, and are located within 25 km of the Proposed Offshore Development::

- CAPTAIN – EOR STAGE 2;
- Green Volt;
- Muir Mhor;
- Eastern GreenLink 2;
- Green Cat Renewable Ltd;
- Broadshore Hub and;
- Marram Wind.

18-286. As presented in **Volume 1, Chapter 7: Benthic and Intertidal Ecology**, there are no significant cumulative impacts anticipated as a result of each phase of the Proposed Offshore Development. As there are not anticipated to be cumulative impacts to the identified blue carbon habitats listed in **Section 18.7.2**, the cumulative effects is considered to be Negligible, which is Not Significant in EIA terms.

18.13.3 Impact 3 CCR assessment

18-287. The Cumulative Effects Assessment (CEA) for a CCR assessment considers the potential for other projects or plans to act collectively to exacerbate a project's climate vulnerability and risk. There is also potential for a project to influence the climate change resilience of other projects or plans.

18-288. The Proposed Offshore Development is not expected to contribute to significant cumulative climate change impacts when considered alongside other offshore projects. This is because, unlike localised environmental effects (such as underwater noise, air emissions, or water quality changes) which can interact directly between nearby developments, climate change impacts arise from global-scale processes.

18-289. Therefore, even if other offshore developments are located relatively nearby, their combined influence on climate change resilience is negligible due to the scale at which climate processes operate. Thus spatial separation is not the primary reason for the low cumulative impact. Rather, it is the nature of climate change itself, being driven by global and not local factors that underpins the conclusion that the cumulative effect is Minor and Not Significant.

18-290. The key point is that climate change operates at a scale far beyond the influence of individual or even clustered offshore wind farm projects. Therefore, even if other offshore developments are located relatively nearby, their presence does not influence the climate change resilience of the Proposed Offshore Development, nor does it influence theirs. The resilience of offshore infrastructure to climate change is shaped by broader climatic trends (e.g. sea level rise, storm intensity, ocean temperature), which are not significantly altered by the presence or absence of neighbouring projects.

18.14 TRANSBOUNDARY EFFECTS

18-291. Transboundary effects are not considered to require specific consideration for the GHG assessment and CCR assessment.

18-292. The receptor for the GHG assessment is the global atmosphere, and therefore GHG emissions have an indirect transboundary effect on climate change. Emissions released and avoided by the Project have been assessed in the context of the UK Carbon Budgets, which have been set in accordance with international climate agreements.

18.15 INTER-RELATED EFFECTS

18-293. The receptor for the GHG assessment is the global atmosphere. There are no other topics which have direct effects on this receptor, and therefore there are no inter-relationships with this topic.

18-294. Similarly, the CCR assessment focuses on the effects of climate change on the Proposed Offshore Development itself, while other topics of the EIA assess the effects of the Proposed Offshore Development on other receptors. There are not considered to be any inter-relationships with other environmental effects related to the Proposed Offshore Development with respect to climate change resilience.

18-295. The Blue Carbon assessment focuses on marine ecosystems and sediments that play a crucial role in carbon sequestration and storage. Ecosystems' health and biodiversity directly influence their capacity to sequester carbon and so disturbances to these habitats can reduce their effectiveness as carbon sinks. Therefore, there are inter-related effects with **Volume 1, Chapter 7: Benthic Intertidal Ecology**, as the Blue Carbon assessment builds upon its methodology and results. The effects in **Volume 1, Chapter 7: Benthic Intertidal Ecology** have been considered in the Blue Carbon assessment, and therefore there are no further inter-related effects.

18.16 SUMMARY

18-296. The construction, operation and decommissioning phases of the Proposed Offshore Development would cause a range of impacts on Climate Change. The magnitude and sensitivity of these impacts has been assessed in reaching a conclusion on likely significant effects. A summary of the residual effects of the Proposed Offshore Development on Climate Change is listed in **Table 18-46**.

18-297. The GHG assessment which considered the GHG emissions associated with the Project, calculated the potential for avoided emissions by replacing electricity that would otherwise have been generated from gas-fired power stations with CCS to be 2.87 million tonnes CO_2e, resulting in a beneficial effect, which is considered to be significant in EIA terms. The GHG assessment also considered GHG emissions associated with the Project and compared these outcomes to the relevant UK and Scotland's recommended Carbon Budgets. The methodology for the GHG assessment is detailed in **Volume 3, Appendix 18.1: Greenhouse Gas Assessment**.

18-298. The Blue Carbon assessment evaluated the Proposed Offshore Development's activities on the carbon sequestration potential of the immediate seabed and associated habitats. The resulting Blue Carbon impact was assessed to be not significant.

18-299. The CCR assessment of the Proposed Offshore Development's vulnerability and resilience to climate change determined that accounting for embedded mitigation, the vulnerability rating of the Proposed Offshore Development to identified climate hazards would be low and medium for the construction, and operation and maintenance phases respectively. However, there was low likelihood that climate change impacts would adversely affect the Proposed Offshore Development during the construction and, operation and maintenance phase, and any effect of climate change on the Proposed Offshore Development would not be significant.

18-300. A high-level assessment of the Proposed Offshore Development's vulnerability and resilience to climate change during the decommissioning phase was undertaken. The vulnerability rating of the Proposed Offshore Development to identified climate hazards would be low and medium for the decommissioning phase. However, a low likelihood of climate change impacts adversely affecting the Proposed Offshore Development during the decommissioning phase was identified, and any effect on climate change on the Proposed Offshore Development would not be significant.

18-301. **Table 18-46** illustrates a summary of the likely significant environmental effects, mitigation, monitoring and residual effects for climate change.

Table 18-46 Summary of the Likely Significant Environmental Effects, Mitigation, Monitoring and Residual Effects for Climate Change

Description of Impact	Phase			Magnitude of Impact	Sensitivity of Receptor	Embedded Mitigation Measures	Significance of Effect	Secondary Mitigation Measures	Residual Effect	Proposed Monitoring
	C	O	D							
Project Alone Summary										
GHG assessment										
Construction GHG emissions	✓			N/A	High	EM8 and AEM54	Minor adverse (not significant in EIA terms)	N/A	Minor adverse (not significant in EIA terms)	N/A
Operation and maintenance GHG emissions		✓		N/A	High	EM33	Beneficial (likely significant effect in EIA terms)	N/A	Beneficial (likely significant effect in EIA terms)	N/A
Decommissioning GHG emissions			✓	N/A	High	EM8	Minor adverse (not significant in EIA terms)	N/A	Minor adverse (not significant in EIA terms)	N/A
Whole life cycle emissions and net effect on climate change	✓	✓	✓	N/A	High	EM8, EM9 and AEM54	Beneficial (likely significant effect in EIA terms)	N/A	Beneficial (likely significant effect in EIA terms)	N/A
Blue Carbon assessment										
Benthic Habitats	✓	✓	✓	Low	High	EM4	Minor effect (not significant in EIA terms)	N/A	Not significant	N/A
Blue Carbon Loss	✓	✓	✓	N/A	High	N/A	Negligible (not significant in EIA terms)	N/A	Not significant	N/A
CCR assessment										
Climate change resilience	✓	✓	✓	N/A	Low	AEM56	Not significant	N/A	Not significant	N/A
Cumulative Summary										
Blue Carbon assessment										
Benthic Habitats	✓	✓	✓	Low	High	EM4	Negligible (not significant in EIA terms)	N/A	N/A	
Blue Carbon Loss	✓	✓	✓	N/A	High	N/A	Negligible (not significant in EIA terms)	N/A	N/A	
CCR assessment										
Climate change resilience	✓	✓	✓	N/A	Low	AEM56	Not significant	N/A	N/A	N/A

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