MachairWind Offshore Windfarm

Appendix 20.2 Climate Change Vulnerability Assessment

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GLOSSARY OF ACRONYMS

Term	Definition
CCR	Climate Change Resilience
EIAR	Environmental Impact Assessment Report
ERCoP	Emergency Response and Cooperation Plan
IAC	Inter-array Cable
O&M	Operation and Maintenance
WDA	Windfarm Development Area
WTG	Wind Turbine Generator
XLPE	Polyethylene

GLOSSARY OF TERMS

Term	Definition
Climate Variable	Climate variable is defined as a measurable, monitorable aspect of the weather or climate such as temperature or wind speed.
Climate Hazard	Climate Hazard is defined as a weather or climate-related event or trend in climate variable, such as storms or heatwaves, which has potential to do harm to receptors.
Climate Change Impact	Climate Change Impact is defined as an impact from a climate hazard, such as asset damage or failure, which affects the ability of the receptor to maintain its function or purpose.
Development Area	Application boundary for consenting purposes which, for the Project, consists of a Windfarm Development Area, Offshore Export Cable Corridor, and Onshore Transmission Development Area. Separate consent and marine licence applications will be submitted for each Development Area where applicable.
Environmental Impact Assessment (EIA) Regulations	A collective term referring to The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 and The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017.
Embedded mitigation measure	Mitigation measures, including industry good practice measures, that are directly incorporated into the design for the MachairWind Windfarm Development Area to avoid or reduce environmental effects.
Environmental Impact Assessment (EIA)	The process of evaluating the likely significant environmental effects of a proposed development over and above the existing circumstances (or 'baseline').
Inter-array cables (IACs)	Armoured cable containing electrical and fibre optic cores which link the wind turbine generators to each other and to the offshore substation platform(s).
Landfall	The area from Mean Low Water Springs to a transition bay(s), where the offshore export cable(s) come ashore.
MachairWind Offshore Windfarm	An offshore windfarm capable of exporting around 2 GW of renewable energy to the National Electricity Transmission System. MachairWind Offshore Windfarm comprises three Development Areas: • The WDA – located on the west coast of Scotland to the northwest of Islay and west of Colonsay; • The Offshore Export Cable Corridor – a preliminary boundary extending from the WDA to mean high water springs at a landfall location near Girvan, South Ayrshire; and • The Onshore Transmission Development Area – a preliminary boundary which extends landward from mean low water springs and includes the land required for the landfall of the offshore export cable(s) and their route up to but not including the proposed high voltage direct current switching station which will be developed and constructed by Transmission Owner, ScottishPower Transmission. Separate consent and licence applications will be submitted for each Development Area.
Mean sea level	The average level of the sea taking account of all tidal effects but excluding surge events.
The Applicant	The legal entity submitting consent applications for the MachairWind Offshore Windfarm, namely MachairWind Limited.
The Project	MachairWind Offshore Windfarm including all its Development Areas and associated infrastructure.
Windfarm Development Area (WDA)	The application boundary within the OAA where consent will be sought for the proposed WDA infrastructure. The WDA infrastructure is subject to Section 36 consent and marine licence applications (generation and transmission) which are being applied for separately from the Offshore ECC infrastructure and OnTDA infrastructure.

Term	Definition
WDA infrastructure	The offshore generation and transmission infrastructure located within the WDA including but not limited to: WTGs, WTG fixed foundations (and associated scour protection), OSP(s), OSP fixed foundations (and associated scour protection), IACs, OSP link and offshore export cable(s) and their associated external cable protection (insofar as these are located within the WDA) and fibre optic cables.

1 CLIMATE CHANGE VULNERABILITY ASSESSMENT

1.1 INTRODUCTION

1. This Climate Vulnerability Assessment is an appendix to **Chapter 20 Climate Change Risk Assessment** of the Machair Windfarm Development Area (WDA) Environmental Impact Assessment Report (EIAR).

2. The purpose of this appendix is to present the climate vulnerability assessment, which forms **Step 2** of the three-step Climate Change Resilience (CCR) assessment (as detailed in **Chapter 20 Climate Change Risk Assessment)**. **Chapter 20 Climate Change Risk Assessment** sets out the four-step methodology which has been adopted for the CCR assessment in line with industry good practice for assessment of CCR.

3. The climate *Vulnerability* assessment is used to evaluate the resulting impact from a climate change which affects the ability of the receptor to achieve or maintain its functions or purpose. This is done by determining the *Sensitivity* of receptors (how strongly they are affected by hazards) and their *Adaptive Capacity* (ability to adjust, cope, or recover), taking into account embedded mitigation measures.

4. The *Sensitivity* has been determined for each combination of *Hazard and Receptor*. This is because the same Receptor could have different *Sensitivity* to different hazards. Sensitivity will also be impacted by the temporal boundary of assessment, due to ageing infrastructure and deterioration. The *Sensitivity* for each combination of *Hazard and Receptor* has been determined based on the criteria set out in **Table 1.1**.

Table 1.1 Criteria for sensitivity rating

Sensitivity Rating	Criteria
High Sensitivity	Hazard impacts on the Receptor can lead to major or permanent damage causing prolonged (higher than 1 day) disruptions, reduced performance, significant costs, and serious or irreversible health and safety risks.
Medium Sensitivity	Hazard impacts on the Receptor may cause moderate but recoverable damage to infrastructure and assets, and deterioration of infrastructure and assets, leading to temporary disruptions, manageable cost implications, and health and safety risks that are generally limited in severity and duration.
Low Sensitivity	Hazard impacts on the Receptor may result in minor to negligible, localized damage to infrastructure and assets, causing limited disruptions, minimal cost implications, and low health and safety risks.

5. Embedded mitigation measures, such as climate-resilient design standards, drainage management plans, emergency response protocols, and adaptive operation and maintenance (O&M) strategies, are considered when determining adaptive capacity. The *Adaptive Capacity* of each Receptor has also been determined for each combination of *Hazard and Receptor* based on **Table 1.2**.

Table 1.2 Criteria for adaptive capacity

Rating	Qualitative Description	Key Indicators
Low Adaptive Capacity	Systems or activities lack resilience, use outdated or vulnerable materials, and have limited access to climate-resilient technologies. Implementation of solutions is difficult or reactive.	• Minimal or no use of resilient materials • Non-standard or improvised practices • Poor access to tools, parts, or skilled labour • No formal emergency plans or training • High reliance on external support during crises

Rating	Qualitative Description	Key Indicators
Medium Adaptive Capacity	Some resilience measures are in place but may rely on partially available materials or less standardized practices. Existing practices are moderately easy to implement but may face delays or limitations during extreme events.	• Partial use of resilient materials or retrofitting • Some adherence to industry standards • Limited access to spare parts or tools • Emergency response plans exist but may lack resources • Moderate training and logistical support
High Adaptive Capacity	Systems or activities are highly resilient, using industry-standard practices and easily accessible, climate-resilient materials and technologies. Solutions are well-integrated, easy to implement, and regularly maintained.	• Use of climate-resilient design and materials (e.g., elevated platforms, corrosion-resistant components) • Standardized construction, operation, and demolition protocols • Reliable access to replacement parts and skilled labour • Redundant systems and remote monitoring • Clear SOPs and trained local teams

6. The *Vulnerability* of each combination of *Hazard and Receptor* is based on **Table 1.3**.

Table 1.3 Vulnerability matrix

Sensitivity	Adaptive Capacity		
	H	M	L
H	Medium Vulnerability	High Vulnerability	High Vulnerability
M	Low Vulnerability	Medium Vulnerability	High Vulnerability
L	Low Vulnerability	Low Vulnerability	Medium Vulnerability

7. The climate vulnerability assessment is presented for each lifetime phase of the WDA infrastructure, including:

- The construction period for the WDA is assumed to be up to 5 years, from 2030 to 2035.
- The operational lifetime is assumed to be up to 35 years, from 2035 to 2070. The design life will be dictated majorly primarily by the equipment suppliers, such as the WTG suppliers, and will reflect market maturity and operational experience globally at the time of construction and during operations. At the end of the design life, any repowering will be subject to separate consents.
- The duration of the decommissioning period will depend on the Machair WDA end-of-life strategy. For but, for EIA purposes, this is assumed to be similar in timescales as duration to the construction period, that is up to 5 years, from 2070 to 2075.

8. A total of 19 potential climate change impacts have been identified and assessed in the climate vulnerability assessment.

9. Of the 19 potential climate change impacts, three impacts were determined to have a high vulnerability despite the implementation of embedded mitigation measures.

10. A breakdown of the potential climate change impacts is provided below:

- Six climate change hazards identified during the construction phase;
- Eight climate change hazards identified during the O&M phase; and
- Five climate change hazards identified during the decommissioning phase.

11. All mitigation relevant mitigation measures detailed in **Table 1.4** to **Table 1.6** are detailed in **Appendix 5 WDA Mitigation and Commitments Register.**

Table 1.4 Climate change vulnerability assessment – construction phase

Climate Hazard	Receptor	Potential climate change impact	Proposed Embedded Mitigation Measure	Sensitivity	Adaptive Capacity	Vulnerability
• Increased frequency and severity of heatwaves. • Increase in average temperatures.	Offshore construction personnel.	Heatwaves and increased average temperatures can lead to increased risk of heat stroke and exhaustion among the workforce.	Measures M-27 in **Appendix 5 WDA Mitigation and Commitments Register**. Implementation of standard CCR measures and emergency response protocols in the Emergency Response and Cooperation Plan (ERCoP) will safeguard the occupational health and safety of personnel. Extreme high temperatures can be managed by altering shift patterns to cooler times during the day and providing additional rest breaks.	High	Medium	High
	Condition and performance of windfarm infrastructure.	High temperatures may reduce the strength and durability of construction materials used during installation of windfarm infrastructure and affect the flexibility and integrity of cables during laying of the inter-array cables (IACs).	Measure M-15 in **Appendix 5 WDA Mitigation and Commitments Register**. The WDA infrastructure will be designed and constructed in accordance with the Applicant's technical requirements and material specifications and based on industry best practice and engineering standards. These may include practices such as: Specifying materials such as cross-linked polyethylene (XLPE) insulation for IACs to maintain flexibility and integrity under high temperatures; Designing structures to accommodate thermal expansion and contraction, including expansion joints in concrete substructures; and Applying heat-reflective coatings to surfaces exposed to direct sunlight to reduce heat absorption and minimise thermal stress.	Low	High	Low
• Increase in storm intensity (wind speed). • Increase in frequency of storm conditions. • Increase in extreme wave height. • Change in storm patterns, e.g. wind direction.	Marine vessels and offshore plant and equipment.	High winds and waves during extreme storm events can result in physical damage to marine vessels and plant and equipment.	Measures M-15, M-27 and M-32 in **Appendix 5 WDA Mitigation and Commitments Register**. Implementation of standard CCR measures and emergency response protocols in the ERCoP will safeguard the occupational health and safety of personnel and prevent damage to vessels and plant and equipment.	Medium	High	Low

Climate Hazard	Receptor	Potential climate change impact	Proposed Embedded Mitigation Measure	Sensitivity	Adaptive Capacity	Vulnerability
			Extreme storm events can be managed by designating safe shelter on board vessels for personnel, securing loose equipment and stored materials during periods of high winds and waves and determining safe limits for working conditions above which vessel activities and crane and rig operations would be halted. Marine vessels and offshore plant are designed and certified to recognised maritime and offshore standards with defined operational limits. Activities are governed by marine coordination procedures, real-time metocean monitoring, conservative weather windows and suspension of works when thresholds are exceeded.			
	Offshore construction personnel.	Extreme storminess can lead to unsafe working conditions.	Measures M-15, M-27 and M-32 in **Appendix 5 WDA Mitigation and Commitments Register**. Implementation of standard CCR measures and emergency response protocols in the ERoCP will safeguard the occupational health and safety of personnel and prevent damage to vessels and plant and equipment. Extreme storm events can be managed by designating safe shelter on board vessels for personnel, securing loose equipment and stored materials during periods of high winds and waves and determining safe limits for working conditions above which vessel activities and crane and rig operations would be halted. Controlled through dynamic risk assessment, permit-to-work systems, stop-work authority, weather-linked exclusion criteria and continual forecast monitoring. These systems are embedded in offshore safety management practices.	Medium	High	Low
Increased frequency and/or severity of all types of extreme weather event, including heatwaves, storms and wave heights.	Offshore construction personnel, marine vessels and plant and equipment.	Increased risk of disruption to offshore construction activities during extreme weather events can lead to programme delays and associated cost implications.	Measures M-27 and M-32 in **Appendix 5 WDA Mitigation and Commitments Register**. Implementation of standard CCR measures and emergency response protocols in the ERCoP will ensure	Medium	High	Low

Climate Hazard	Receptor	Potential climate change impact	Proposed Embedded Mitigation Measure	Sensitivity	Adaptive Capacity	Vulnerability
		Prolonged or successive disruptions can result in impacts to the overall WDA infrastructure construction programme.	that construction activities are scheduled considering weather conditions and safe working limits. The ERCoP will enable construction activities to adapt to deal with extreme weather events and will require suitable contingencies are built into the programme to allow for unforeseen disruptions. Specific mitigation measures to manage direct impacts due to each type of extreme weather event on personnel, vessel, plant and equipment are discussed elsewhere in this table in relation to the relevant climate change impacts. Regular inspections should be undertaken to ensure that any damage due to extreme weather is identified and addressed as soon as possible. Real-time monitoring of weather conditions will enable activities to be adjusted as needed.			

Table 1.5 Climate change vulnerability assessment – operation phase

Climate Hazard	Receptor	Potential climate change impact	Proposed Embedded Mitigation Measure	Sensitivity	Adaptive Capacity	Vulnerability
Change in various environmental conditions, e.g. increase in average sea surface temperatures, salinity, strong waves and sea level rise can increase water damage and corrosion risks.	Condition and performance of windfarm infrastructure.	Exposure to strong waves, increasing sea salinity and surface temperatures, compounded by sea level rise, storm surges and tidal changes, can increase the risk of water damage and saltwater corrosion to submerged structures. This may result in physical damage and deterioration and decline in operational performance.	Measure M-1, M-15 in **Appendix 5 WDA Mitigation and Commitments Register**. The windfarm infrastructure will be designed and constructed in accordance with the Applicant's technical requirements and material specifications and based on industry best practice and engineering standards. These may include practices such as: Attaching sacrificial anodes to submerged structures to extend their lifespan; Using impressed current cathodic protection systems to prevent corrosion; Specifying materials such as stainless or galvanised steel that resist corrosion in marine environments; Applying durable epoxy, polyurethane or other anti-corrosion coatings to metal surfaces to prevent saltwater corrosion; Ensuring all joints, seams, and penetrations are properly sealed and waterproofed to prevent water ingress; Employing concrete mixes with additives to enhance durability and resistance to chloride penetration; and Incorporating climate change allowances into the design of offshore infrastructure such as accounting for rising sea level and increased storm intensity in the elevation of above-sea structures. Measure M-1, M-4 in **Appendix 5 WDA Mitigation and Commitments Register**. O&M activities to ensure continued resilience of submerged structures may include: Regularly cleaning submerged structures to remove marine growth and debris that can accelerate corrosion; Scheduling regular inspections to reapply protective coatings and address any signs of corrosive damage; and Conducting underwater inspections and monitoring of installed scour and cable protection to detect and remediate physical damage and deterioration.	Low	High	Low

Climate Hazard	Receptor	Potential climate change impact	Proposed Embedded Mitigation Measure	Sensitivity	Adaptive Capacity	Vulnerability
Change in frequency of ice conditions.	Condition and performance of wind turbine generators (WTGs).	Cold weather can lead to ice accretion on WTGs and therefore decreasing their operational performance.	Measure M-4 in **Appendix 5 WDA Mitigation and Commitments Register**. O&M activities to ensure continued resilience of WTGs may include: Applying hydrophobic blade coatings ahead of the winter to prevent ice accumulation; Implementing protocols for shutting down WTGs when ice accumulation is detected to prevent damage; Conducting regular visual inspections of WTGs, especially after severe weather events to identify and address ice-related issues; Continuously monitoring WTG performance to detect any efficiency losses due to ice accretion; and Restricting access to areas around WTGs during icy conditions to protect O&M personnel from falling ice.	Low	High	Low
Increased frequency and severity of heatwaves. Increase in average temperatures.	Condition and performance of offshore platform(s)	Overheating of electrical equipment in offshore platform(s) such as switchgears and transformers can result in physical damage and deterioration and decline in operational performance due to shutdowns.	Measure M-1, M-15 in **Appendix 5 WDA Mitigation and Commitments Register**. The windfarm infrastructure will be designed and constructed in accordance with the Applicant's technical requirements and material specifications and based on industry best practice and engineering standards. These may include practices such as: Compliance with international standards and guidelines for wind turbine design, electrical systems, and offshore structures. Use of corrosion-resistant materials and protective coatings, along with robust quality assurance and testing during fabrication and installation. Integration of thermal management and environmental protection measures for electrical components to prevent overheating and salt-induced degradation; and Designing for resilience and safety, including redundancy in critical systems and adherence to recognized health and safety standards. Measure M-4 in **Appendix 5 WDA Mitigation and Commitments Register**.	Low	High	Low

Climate Hazard	Receptor	Potential climate change impact	Proposed Embedded Mitigation Measure	Sensitivity	Adaptive Capacity	Vulnerability
			O&M activities to ensure continued resilience of WTGs may include: Continuously monitoring temperatures of electrical components such as switchgears and transformers using sensors and Supervisory Control and Data Acquisition (SCADA) systems to detect overheating early; Performing infrared thermography inspections during scheduled maintenance to identify hotspots and prevent thermal damage; Maintaining cooling and ventilation systems, including cleaning filters and checking fans to ensure effective heat dissipation; Conducting regular inspections of insulation, busbars, and enclosures for signs of thermal aging or corrosion, especially in harsh offshore environments; Implementing condition-based maintenance using predictive analytics from temperature, vibration, and load data to anticipate failures before they occur; Applying anti-corrosion coatings and ensuring sealed enclosures to protect electrical equipment from salt spray and humidity; Managing electrical loads dynamically to avoid prolonged overloads that accelerate heating and stress on components; Maintaining spare parts inventory and emergency shutdown protocols to minimize downtime and prevent cascading failures during overheating events.			
Increase in frequency and intensity of extreme precipitation events.	Condition and performance of WTGs.	Increased in precipitation and moisture can result in physical damage and deterioration of WTGs due to blade edge erosion and decline in operational performance.	Measure M-4 in **Appendix 5 WDA Mitigation and Commitments Register**. Activities to ensure continued resilience of WTGs may include: Scheduling regular inspections to reapply protective coatings to WTG blades and address any signs of blade edge erosion; and	Low	High	Low

Climate Hazard	Receptor	Potential climate change impact	Proposed Embedded Mitigation Measure	Sensitivity	Adaptive Capacity	Vulnerability
			Continuously monitoring of WTG performance to detect any efficiency losses due to blade edge erosion.			
• Increase in storm intensity (wind speed). • Increase in frequency of storm conditions. • Change in storm patterns, e.g. wind direction.	Condition and performance of WTGs.	Extreme storm events can result in physical damage and deterioration of WTGs and decline in operational performance due to shutdowns.	Measure M-15 in **Appendix 5 WDA Mitigation and Commitments Register**. WTGs will be designed and constructed in accordance with the Applicant's technical requirements and material specifications and based on industry best practice and engineering standards. These may include practices such as using aerodynamic design, reinforced structures and durable materials to withstand increased loading and ensure the structural integrity of WTGs. Measure M-4 in **Appendix 5 WDA Mitigation and Commitments Register**. O&M activities to ensure continued resilience of WTGs may include: Monitoring the operational health of WTGs and adapting their operations to wind conditions; and Adjusting WTG operations to minimise exposure to harsh weather, such as altering blade angles and, at wind speeds above the design load limit, temporarily shutting down WTGs in an idle configuration to prevent structural damage during gusts or sustained high winds. Marine vessels and offshore plant are designed and certified to recognised maritime and offshore standards with defined operational limits. Activities are governed by marine coordination procedures, real-time metocean monitoring, conservative weather windows and suspension of works when thresholds are exceeded. WTGs are designed and certified in accordance with international IEC standards for extreme wind and storm loading. Automatic shutdown and storm protection modes are inherent design features that protect assets during extreme events.	Low	High	Low
• Increase in storm intensity (wind speed). • Increase in extreme wave height. • Increase in frequency of storm conditions.	Offshore O&M personnel	Extreme storm events can lead to unsafe working conditions and disrupt O&M activities.	Measure M-47 in **Appendix 5 WDA Mitigation and Commitments Register**. Implementation of standard CCR measures and emergency response protocols in O&M management plans will	Medium	High	Low

Climate Hazard	Receptor	Potential climate change impact	Proposed Embedded Mitigation Measure	Sensitivity	Adaptive Capacity	Vulnerability
• Change in storm patterns, e.g. wind direction.			safeguard the occupational health and safety of personnel and ensure O&M activities can adapt to extreme storm events. Controlled through dynamic risk assessment, permit-to-work systems, stop-work authority, weather-linked exclusion criteria and continual forecast monitoring. These systems are embedded in offshore safety management practices. O&M access criteria, vessel transfer limits, work suspension protocols and use of remote monitoring systems are standard operational practices that minimise offshore intervention during adverse weather.			
• Increased tidal range. • Increase in extreme wave height.	Condition and performance of windfarm infrastructure.	Increased wave and tidal activities can increase loading and sediment transport across the seabed, resulting in physical damage and deterioration of submerged structures and decline in operational performance due to scour and erosion.	Measure M-1, M-15 in **Appendix 5 WDA Mitigation and Commitments Register**. The WDA infrastructure will be designed and constructed in accordance with the Applicant's technical requirements and material specifications and based on industry best practice and engineering standards. These may include practices such as: Installing scour protection around WTG station keeping systems and subsea cable hubs; Installing cable protection around unburied cables, cable crossings and transition points where the IACs exit the seabed trench and connect into WTGs and subsea cable hubs; and Accounting for resilience against scour and sediment transport in the design of station keeping systems and cables. Measure M-1, M-4 in **Appendix 5 WDA Mitigation and Commitments Register**. O&M activities to ensure continued resilience of submerged structures may include: Managing sediment transport through sediment traps to maintain seabed integrity; and Conducting underwater inspections and monitoring of installed scour and cable protection to detect and remediate physical damage and deterioration.	Low	High	Low

Climate Hazard	Receptor	Potential climate change impact	Proposed Embedded Mitigation Measure	Sensitivity	Adaptive Capacity	Vulnerability
			Foundations and cables are designed using site-specific metocean and geotechnical data, with embedded scour protection, burial depth and cable protection systems. Long-term inspection and maintenance form part of standard asset integrity management.			
Increased frequency and/or severity of all types of extreme weather event or climate hazard, including heatwaves, storms, wave height, precipitation, lightning, tidal range, coastal erosion and changes in marine environmental conditions.	Condition and performance of windfarm infrastructure.	Major damage and/or increased rate of deterioration in condition due to extreme weather events could require more frequent repairs and replacements, raising O&M costs and disrupting activities.	Measure M-4 in **Appendix 5 WDA Mitigation and Commitments Register**. Regular and periodic inspections and maintenance will be undertaken over the operational lifetime to identify and remediate any damage and deterioration and ensure good conditions and performance. Monitoring of exposure to climate hazards and performance during extreme weather events will inform the planning of maintenance and major repair and replacement requirements. Specific mitigation measures to manage the direct impacts of climate change on windfarm infrastructure during the operation phase are discussed elsewhere in this table in relation to the relevant climate change impacts.	Low	High	Low

Table 1.6 Climate change vulnerability assessment – decommissioning phase

Climate Hazard	Receptor	Potential climate change impact	Proposed Embedded Mitigation Measure	Sensitivity	Adaptive Capacity	Vulnerability
• Increased frequency and severity of heatwaves. • Increase in average temperatures.	Offshore decommissioning personnel.	Heatwaves and increased average temperatures can lead to increased risk of heat stroke and exhaustion among the workforce.	Measures M-27 and M-46 in **Appendix 5 WDA Mitigation and Commitments Register**. Implementation of standard CCR measures and emergency response protocols in decommissioning management plans will safeguard the occupational health and safety of personnel. Extreme high temperatures can be managed by altering shift patterns to cooler times during the day and providing additional rest breaks.	High	Medium	High
• Increase in storm intensity (wind speed). • Increase in frequency of storm conditions. • Increase in extreme wave height. • Change in storm patterns, e.g. wind direction.	Marine vessels and offshore plant and equipment.	High winds and waves during extreme storm events can result in physical damage to marine vessels and plant and equipment.	Measures M-27, M-32 and M-46 in **Appendix 5 WDA Mitigation and Commitments Register**. Implementation of standard CCR measures and emergency response protocols in decommissioning management plans will safeguard the occupational health and safety of personnel and prevent damage to vessels and plant and equipment. Extreme storm events can be managed by designating safe shelter on board vessels for personnel, securing loose equipment and stored materials during periods of high winds and waves and determining safe limits for working conditions above which vessel activities and crane and rig operations would be halted. Marine vessels and offshore plant are designed and certified to recognised maritime and offshore standards with defined operational limits. Activities are governed by marine coordination procedures, real-time metocean monitoring, conservative weather windows and suspension of works when thresholds are exceeded.	Medium	High	Low

Climate Hazard	Receptor	Potential climate change impact	Proposed Embedded Mitigation Measure	Sensitivity	Adaptive Capacity	Vulnerability
	Offshore decommissioning personnel.	Extreme storminess can lead to unsafe working conditions.	Measures M-27, M-32 and M-46 in **Appendix 5 WDA Mitigation and Commitments Register**. Implementation of standard CCR measures and emergency response protocols in decommissioning management plans will safeguard the occupational health and safety of personnel and prevent damage to vessels and plant and equipment. Extreme storm events can be managed by designating safe shelter on board vessels for personnel, securing loose equipment and stored materials during periods of high winds and waves and determining safe limits for working conditions above which vessel activities and crane and rig operations would be halted. Controlled through dynamic risk assessment, permit to work systems, stop work authority, weather linked exclusion criteria and continual forecast monitoring. These systems are embedded in offshore safety management practices-to-work systems, stop-work authority, weather-linked exclusion criteria and continual forecast monitoring. These systems are embedded in offshore safety management practices.	Medium	High	Low
Increased frequency and/or severity of all types of extreme weather event, including heatwaves, storms and wave heights.	Offshore decommissioning personnel, marine vessels and plant and equipment.	Increased risk of disruption to offshore decommissioning activities during extreme weather events can lead to programme delays and associated cost implications.	Measures M-27, M-32 and M-46 in **Appendix 5 WDA Mitigation and Commitments Register**. Implementation of standard CCR measures and emergency response protocols in decommissioning management plans will ensure that decommissioning activities are scheduled considering weather conditions and safe working limits. The management plans will enable decommissioning activities to adapt to deal with extreme weather events and will require suitable contingencies are built into the programme to allow for unforeseen disruptions.	High	Medium	High

Climate Hazard	Receptor	Potential climate change impact	Proposed Embedded Mitigation Measure	Sensitivity	Adaptive Capacity	Vulnerability
		Prolonged or successive disruptions can result in impacts on the overall decommissioning programme.	Specific mitigation measures to manage direct impacts due to each type of extreme weather event on personnel, vessels, plant and equipment are discussed elsewhere in this table in relation to the relevant climate change impacts. Regular inspections should be undertaken to ensure that any damage due to extreme weather is identified and addressed as soon as possible. Real-time monitoring of weather conditions will enable activities to be adjusted as needed. Managed through embedded schedule contingency, weather downtime allowances, adaptive marine planning and contractual risk provisions. Programme management practices reflect long established offshore industry experience. Addressed through phased decommissioning strategies, flexible sequencing of activities, contingency planning and weather informed logistics. Cumulative weather risk is routinely accommodated within baseline schedules. -informed logistics. Cumulative weather risk is routinely accommodated within baseline schedules.			