AQUIND Limited

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Environmental Statement – Volume 3 – Appendix 28.2 Climate Vulnerability Assessment

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APPENDIX 28.2 CLIMATE VULNERABILITY ASSESSMENT

1.1. INTRODUCTION

1.1.1.1. This appendix contains the climate vulnerability assessment carried out as part of the Environmental Impact Assessment ('EIA').

1.2. METHODS OF ASSESSMENT

1.2.1.1. This section outlines the approach for assessing the resilience of the Proposed Development to climate change. The methodology consists of four stages and is based on a Climate Risk and Vulnerability Assessment ('CRVA') approach, the guidance listed in Chapter 28 (Carbon and Climate Change) of the Environmental Statement ('ES') Volume 1 (document reference 6.1.28) and professional experience of carrying out similar assessments. Initially a vulnerability assessment is undertaken to identify climate variables to which the Proposed Development is vulnerable. A more detailed risk assessment is then undertaken to assess the level of risk associated with hazards caused by the climate variables.

1.2.1.2. The results of Steps 1 and 2 (the vulnerability assessment) are reported in this appendix and the more detailed risk assessment (Steps 3 and 4) are reported in the ES.

1.2.1.3. Step 1: Identify receptors - during this stage, relevant receptors which may be affected by climate change are identified. These receptors may comprise both known (i.e. receptors affected by historical flooding gleaned from literature review) and unknown (new) receptors.

1.2.1.4. Step 2: Climate vulnerability assessment - this stage comprises an assessment of the vulnerability of the Proposed Development to change in climate variables. The assessment is qualitative, informed by professional judgement and supporting literature.

1.2.1.5. The vulnerability of a Proposed Development to extreme weather and climate change is a function of:

- The typical sensitivity of the type of the Proposed Development to climate variables; and
- The geographic exposure of the Proposed Development to climate variables.

1.2.1.6. The climate vulnerability assessment is informed by an assessment of sensitivity and exposure. A categorisation is then assigned to each climate variable based on the following scale:

- High: High climate sensitivity/exposure;
- Moderate: Moderate climate sensitivity/exposure; and
- Low: No significant climate sensitivity/exposure.

1.2.1.7. The vulnerability of primary receptors climate variables is then determined using the matrix in Table 1 vulnerabilities are taken forward to risk assessment in Step 3.

Table 1 – Vulnerability Rating Matrix

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

1.2.1.8. Step 3: Risk assessment - firstly, hazards related to Medium and High vulnerabilities are identified. The foundation for this is expert judgment, engagement with the project team and a review of relevant literature. Following identification of hazards, a risk assessment is undertaken. Risk is a product of likelihood and consequence of the hazards occurring. A risk rating for each hazard is assigned by combining likelihood and consequence ratings, as shown in Table 2.

Table 2 – Risk Rating Matrix

	Consequence				
Likelihood	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

1.2.1.9. Step 4: Mitigation measures - in the final step, mitigation measures for Extreme, High and Medium risks are identified through consultation with the design team and through expert opinion. Designers will be asked to identify what measures they are taking to improve resilience to the identified climate risks. Taking account of these measures, a resilience rating for each hazard is given, based on the following definitions:

- High - a strong degree of climate resilience, remedial action or adaptation may be required but is not a priority.
- Moderate - a moderate degree of climate resilience, remedial action or adaptation is suggested.
- Low – a low level of climate resilience, remedial action or adaptation is required as a priority.

1.2.1.10. Recommendations for supplementary climate change adaptation measures of climate resilience are identified.

1.2.2. SIGNIFICANCE CRITERIA

1.2.2.1. Step 5 - the significance of climate risks and the level of resilience of the Proposed Development to these risks will be defined based on the tables set out above. Table 3 shows how significance will be defined.

Table 3 – Vulnerability Rating Matrix

	Resilience Rating		
Risk Rating	High	Medium	Low
Extreme	Significant	Significant	Significant
High	Not significant	Significant	Significant
Medium	Not significant	Not significant	Significant
Low	Not significant	Not significant	Not significant

1.3. RESULTS OF THE VULNERABILITY ASSESSMENT

1.3.1. STEP 1 – IDENTIFY RECEPTORS

1.3.1.1. As the vulnerability assessment is an assessment of the impacts of climate change on the Proposed Development, the receptor is the Proposed development, as described in Chapter 3 (Description of the Proposed Development) of the ES Volume 1 (document reference 6.1.3).

1.3.2. STEP 2 – VULNERABILITY ASSESSMENT

1.3.2.1. The vulnerability of a Proposed Development to extreme weather and climate change is a function of:

- The typical sensitivity of the type of the scheme to climate variables; and
- The geographic exposure of the scheme to climate variables.

Sensitivity

Sea

1.3.2.2. Energy sector infrastructure is sensitive to changes in sea level, particularly electrical substations and supporting infrastructure. Section 10 lies within Flood Zone 2/3 and Sections 6, 7, 8 and 9 are within Flood Zone 3 and are therefore at risk of tidal flooding (see Chapter 20 (Surface Water Resources and Flood Risk) of the ES Volume 1 (document reference 6.1.20)). Sea level rise caused by climate change could increase the risk of tidal flooding over the lifetime of the Proposed Development. Coastal flooding due to sea level rise or storm surge can directly cause damage to energy infrastructure such as cables, cable joints and the transition joint bay as well as potentially reducing earthwork stability and hastening the deterioration of materials. It's worth noting that flood risk may also depend strongly on the design of the new infrastructure as well as its siting (Adaptation Sub Committee, 2016). Power outages and threats to business continuity are the main risks associated with sea level rise and storm surge.

Precipitation

1.3.2.3. Energy infrastructure is sensitive to high and low rainfall (McColl, Angelini, & Betts, 2012). Sections 1, 2 and 3 (central/western option) lie in. The Proposed Development within EA Flood Zone 1 and (see Chapter 20 (Surface Water Resources and Flood Risk)) where there is a risk of fluvial flooding. Fluvial flooding may directly damage energy infrastructure, potentially reducing earthwork stability and hastening the deterioration of materials. Parts of Section 1 and 2 are at risk of pluvial flooding. High ground water levels may also cause pollutants in the soil to be mobilised, potentially affecting building materials.

1.3.2.4. Prolonged periods of low rainfall or drought can also impact built infrastructure. Drying out and cracking of soils and/or the aquifer may affect structural stability and prolonged dry periods can lead to cracking of surfaces and more rapid deterioration of materials. The converter station could be sensitive to the impacts of drought as it is located over an aquifer.

1.3.2.5. Snow and ice can cause damage to above-ground infrastructure, including roofs and damage external plant and equipment.

Temperature

1.3.2.6. Energy infrastructure is sensitive to high and low temperatures, primarily through exacerbating existing faults. Higher temperatures over more prolonged periods could lead to overheating of infrastructure or greater demand for cooling. Electronic and ICT equipment and substations are also particularly sensitive to extreme temperatures. Overheating may lead to operational impacts if supporting equipment is damaged or working conditions are unsafe.

1.3.2.7. Higher temperatures could also affect material structure and fabric and may cause the deterioration of certain materials, including buildings. Higher temperatures will also lead to increased temperature of river flows that are used for cooling, thereby reducing efficiency of this process.

Wind and storms

1.3.2.8. High wind speeds and gusts can have impacts on energy infrastructure. It is important to note that whilst the short-term consequences of wind-related disruption are large, repairs may usually be carried out quickly. High winds and storms can affect the stability of above-ground infrastructure and hasten material degradation. High winds can also cause wind-driven rain infiltration into plant, building materials and surfaces which can increase maintenance costs and operational disruption.

1.3.2.9. Lightning strike can cause fire as well as power surges and shock waves which can destabilise energy systems, as well as causing damage to electronic and ICT equipment, including substations.

Relative humidity

1.3.2.10. Humidity affects both the performance of energy systems as well as the comfort of personnel. An increase in humidity can increase condensation, mould growth, mildew, staining and the corrosion and decay of metal surfaces, as well as poor performance of insulation.

Water quality and soils

1.3.2.11. Water availability can cause a number of impacts to water quality and soils. For example, greater water volumes can increase the mobilisation of pollutants in soils whilst water scarcity can increase the accumulation of chemicals and pollutants which may cause increased salinity and acidification. More acidic soils and/or water will increase the deterioration of building materials.

1.3.2.12. Table 4 shows the sensitivity of the Proposed Development to climate variables, based on the information presented above and professional judgement.

Table 4 – Sensitivity Assessment

Variable		Sensitivity
Sea	Sea level rise	High
	Storm surge and storm tide	High
Precipitation	Change in annual average	Low
	Drought	Moderate
	Extreme precipitation events (flooding)	High
	Snow and ice	Low
Temperature	Change in annual average	Low
	Extreme temperature events	Moderate
	Solar radiation	Low
Wind	Gales and extreme wind events	Moderate
	Storms (inc. lightning, hail)	High
Humidity	Change in annual average	Low
Water quality and soils	Soil moisture	Moderate
	Salinity/pH	Low
	Soil stability	Moderate
	Runoff	Low

Exposure

Exposure Assessment

1.3.2.13. Based on the information provided and professional judgement, the exposure of the Proposed Development to climate variables is shown in Table 5.

Table 5 – Exposure Assessment

Variable		Exposure
Sea	Sea level rise	High
	Storm surge and storm tide	High
Precipitation	Change in annual average	Moderate
	Drought	Moderate
	Extreme precipitation events (flooding)	High
	Snow and ice	Low
Temperature	Change in annual average	Moderate
	Extreme temperature events	High
	Solar radiation	Moderate
Wind	Gales and extreme wind events	Moderate
	Storms (inc. lightning, hail)	Moderate
Humidity	Change in annual average	Moderate
Water quality and soils	Soil moisture	Moderate
	Salinity/pH	High
	Soil stability	Moderate
	Runoff	Moderate

Vulnerability Assessment

1.3.2.14. The sensitivity and exposure assessments are combined to give an overall assessment of vulnerability of the Proposed Development to climate variables. Table 6 summarises the results of the vulnerability assessment. Climate variables assessed as high or medium vulnerability have been taken forward for more detailed risk assessment within the ES, following the method set out in Steps 3 and 4 in Section 1.3.

Table 6 – Vulnerability Assessment

Variable		Sensitivity	Exposure	Vulnerability
Sea	Sea level rise	High	High	High
	Storm surge and storm tide	High	High	High
Precipitation	Change in annual average	Low	Moderate	Low
	Drought	Moderate	Moderate	Moderate
	Extreme precipitation events (flooding)	High	High	High
	Snow and ice	Low	Low	Low
Temperature	Change in annual average	Low	Moderate	Low
	Extreme temperature events	Moderate	High	Moderate
	Solar radiation	Low	Moderate	Low
Wind	Gales and extreme wind events	Moderate	Moderate	Moderate
	Storms (inc. lightning, hail)	High	Moderate	Moderate
Humidity	Change in annual average	Low	Moderate	Low
Water quality and soils	Soil moisture	Moderate	Moderate	Moderate
	Salinity/pH	Low	High	Low
	Soil stability	Moderate	Moderate	Moderate
	Runoff	Low	Moderate	Low

1.4. SUMMARY AND CONCLUSIONS

1.4.1.1. Those climate variables to which the Proposed Development has been identified as having high or medium vulnerability has been taken forward for more detailed risk assessment, presented in the ES. Climate variables which have been assessed as low vulnerability will be scope out of further assessment. As such, the following variable are scoped in:

- Sea level rise;
- Storm surge and storm tide;
- Drought;
- Extreme precipitation events;
- Extreme temperature events;
- Gales and extreme wind;
- Storms (including lighting and hail);
- Soil moisture; and
- Soil stability.

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