Appendix 16.2

Climate Change Risk

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HERBATA DATA CENTRE, NAAS

Environmental Statement: Appendix 16.2 - Climate Risk

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1 CLIMATE CHANGE RISK

1.1 Overview

1.1.1 This appendix to Chapter 16: Climate Change summarises potential changes in climatic parameters at the Project location and considers whether there is potential for likely significant environmental effects.

1.1.2 Besides climate risks to the Project itself, there are potential inter-relationships between climate change and several other environmental topic areas reported in other chapters of the EIAR, most notably flood risk. The climate projections summarised in this appendix have been provided to all ES chapter authors in order that any changes in the future baseline or sensitive receptors due to climate change can be evaluated if relevant to the respective impact assessments.

1.2 Climate Change Projections

1.2.1 Climate change projections have been established using the Climate Impact Explorer (CIE) (Climate Analytics, 2022). The CIE provides continental, national and subnational level projections of a range of climate impact indicators (such as increased maximum air temperature) to the end of the century under a series of global warming scenarios. The information is derived from an ensemble of climate and climate impact models that have been used in international model intercomparison initiatives. The aim of the tool is to show climate impact outcomes for different emissions scenarios, also providing the associated full uncertainty ranges across global warming levels.

1.2.2 The CIE draws data from two main sources, the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) and CLIMADA. However, projections used in this assessment has utilised projections drawn from ISIMIP data, a description of which is given below:

- ISIMIP –a community-driven initiative with the aim of offering a consistent climate change impact modelling framework. By early 2021, more than 100 models had contributed to the initiative. The CIE makes use of data from ISIMIP phase 2b in their models. ISIMIP2b is available at a spatial resolution equivalent to 50km, hence the highest level of accuracy it can attain is the regional (provincial) level. The ISIMIP2b climate input data was obtained using four General Circulation Models (GCMs) from the fifth phase of the Coupled Model Intercomparison Project (CMIP5). They have been bias-adjusted, meaning that biases between the values simulated by each GCM and those from an observation-based reference dataset over a common period have been corrected. ISIMIP modelling has been utilised throughout Intergovernmental Panel on Climate Change (IPCC) reporting.

1.2.3 Climate projections used for this assessment focus on County Kildare, Ireland, and consider the Representative Concentration Pathway (RCP) 8.5 scenario[1], compared to a 1986-2006 baseline reference period. This is a conservative (worst-case) approach for the assessment.

[1] The RCPs are greenhouse gas concentration scenarios that are commonly used in the climate modelling community. Produced within CMIP5, they were officially adopted by the IPCC and provide a low-high range in potential global GHG reduction initiatives and resulting rate of climatic effects over a given time period. They have been used as a basis for the projections and predictions of the Fifth Assessment Report of the IPCC. The RCPs are defined by the approximate level of radiative forcing (in W/m^2) by the end of the 21st century, relative to the pre-industrial level. The use of radiative forcing allows the calibration of different warming potentials of various greenhouse gases. The word “representative” signifies that each pathway is an archetype of several scenarios sharing similar radiative forcing and emission characteristics.

1.2.4 The Project is expected to have an initial 50 year design life. Climate change projections have been sourced in 5 year time slices from 2020-2080 to ensure full coverage of the Project's life, and are summarised within Table 1.1 to Table 1.7.

1.2.5 In summary, the data within the tables below show that temperatures are anticipated to increase across the year. There will be increased intensity in precipitation trends: precipitation is predicted to increase during the winter season and decrease during the summer season. Additionally, humidity is anticipated to increase. The tables below indicate that these trends will continue and amplify towards the end of the century.

1.2.6 Table 1.1 shows that under the median RCP8.5 scenario, annual maximum air temperatures in County Kildare are projected to steadily increase across the Project's lifetime.

Table 1-1: Maximum Air Temperature†(°C)

Year	2.5th percentile	Median	97.5th percentile
2020	0.23	0.59	1.08
2025	0.29	0.69	1.46
2030	0.38	0.91	1.65
2035	0.45	1.15	1.83
2040	0.63	1.35	2.04
2045	0.72	1.47	2.24
2050	0.89	1.57	2.57
2055	0.96	1.80	2.87
2060	1.03	1.92	3.47
2065	1.05	2.23	3.62
2070	1.13	2.40	4.05
2075	1.23	2.68	4.32
2080	1.27	3.04	4.32

† daily mean, maximum or minimum, as applicable, averaged over time period specified
n.b. 2.5th and 97.5th percentile and median values for scenario RCP8.5

1.2.7 Table 1.2 shows that under the median RCP8.5 scenario, annual minimum air temperatures in County Kildare are projected to steadily increase across the Project's lifetime.

Table 1-2: Minimum Air Temperature† (°C)

Year	2.5th percentile	Median	97.5th percentile
2020	0.17	0.45	1.15
2025	0.20	0.50	1.45
2030	0.24	0.68	1.59
2035	0.27	0.90	1.76
2040	0.40	1.06	1.86
2045	0.50	1.21	2.02
2050	0.64	1.31	2.33
2055	0.69	1.45	2.69
2060	0.79	1.58	3.12
2065	0.82	1.93	3.31
2070	0.86	2.15	3.63
2075	0.91	2.47	3.75
2080	0.95	2.75	3.75

† daily mean, maximum or minimum, as applicable, averaged over time period specified
n.b. 2.5th and 97.5th percentile and median values for scenario RCP8.5

1.2.8 Table 1.3 shows that under the median RCP8.5 scenario, annual mean air temperatures in County Kildare are projected to steadily increase across the Project's lifetime.

Table 1-3: Mean Air Temperature† (°C)

Year	2.5th percentile	Median	97.5th percentile
2020	0.25	0.52	1.21
2025	0.30	0.59	1.50
2030	0.35	0.78	1.63
2035	0.40	0.99	1.78
2040	0.53	1.15	1.94
2045	0.62	1.29	2.11
2050	0.76	1.39	2.41
2055	0.81	1.62	2.67
2060	0.90	1.75	3.06
2065	0.92	2.09	3.23
2070	0.99	2.26	3.60
2075	1.11	2.50	3.80
2080	1.14	2.76	3.80

† daily mean, maximum or minimum, as applicable, averaged over time period specified
n.b. 2.5th and 97.5th percentile and median values for scenario RCP8.5

1.2.9 Table 1.4 shows that under the median RCP8.5 scenario, annual precipitation change in County Kildare is projected to steadily increase across the Project's lifetime.

Table 1-4: Annual Precipitation Change† (%)

Year	2.5th percentile	Median	97.5th percentile
2020	-2.08	1.61	7.39
2025	-1.64	1.07	7.26
2030	-2.52	0.16	7.71
2035	-1.64	1.44	8.23
2040	-2.52	2.26	7.71
2045	-2.21	2.84	8.29
2050	-0.66	2.11	10.16
2055	-0.38	2.21	11.16
2060	0.17	2.71	10.83
2065	0.17	4.71	13.45
2070	-0.80	5.34	13.21
2075	-0.35	5.86	13.34
2080	-0.11	5.51	13.34

† daily mean, maximum or minimum, as applicable, averaged over time period specified
n.b. 2.5th and 97.5th percentile and median values for scenario RCP8.5

1.2.10 Table 1.5 shows that under the median RCP8.5 scenario, summer precipitation change in County Kildare is projected to steadily decrease across the Project's lifetime, leading to dryer summers.

Table 1-5: Summer Precipitation Change† (%)

Year	2.5th percentile	Median	97.5th percentile
2020	-6.98	2.45	36.68
2025	-11.61	1.31	35.47
2030	-13.11	1.52	33.89
2035	-13.58	-2.82	32.19
2040	-14.98	-4.31	31.28
2045	-17.21	-4.21	28.86
2050	-16.85	-5.22	23.43
2055	-18.13	-6.38	23.22
2060	-17.21	-8.35	22.20
2065	-17.41	-7.96	21.10
2070	-29.83	-7.63	19.02
2075	-26.16	-7.15	17.25
2080	-26.16	-4.31	16.15

† daily mean, maximum or minimum, as applicable, averaged over time period specified
n.b. 2.5th and 97.5th percentile and median values for scenario RCP8.5

1.2.11 Table 1.6 shows that under the median RCP8.5 scenario, winter precipitation change in County Kildare is projected to steadily increase across the Project's lifetime, leading to wetter winters.

Table 1-6: Winter Precipitation Change† (%)

Year	2.5th percentile	Median	97.5th percentile
2020	-2.61	3.92	14.29
2025	-1.82	3.34	15.96
2030	-3.19	2.34	17.83
2035	-1.82	5.79	17.59
2040	-3.19	7.73	18.25
2045	-1.81	8.24	21.26
2050	0.00	7.01	24.11
2055	1.46	9.79	27.57
2060	1.59	11.49	30.26
2065	0.77	14.46	24.11
2070	0.07	16.87	31.01
2075	2.22	18.57	28.24
2080	3.06	20.48	29.86

† daily mean, maximum or minimum, as applicable, averaged over time period specified
n.b. 2.5th and 97.5th percentile and median values for scenario RCP8.5

1.2.12 Table 1.7 shows that under the median RCP8.5 scenario, specific humidity in County Kildare is projected to steadily increase across the Project's lifetime.

Table 1-7: Specific Humidity† (%)

Year	2.5th percentile	Median	97.5th percentile
2020	1.66	3.14	7.12
2025	1.79	3.72	8.97
2030	2.01	5.08	10.14
2035	2.36	6.22	11.79

Year	2.5th percentile	Median	97.5th percentile
2040	3.26	7.39	13.54
2045	3.62	8.55	15.01
2050	4.27	9.56	17.95
2055	4.66	11.39	20.58
2060	5.37	12.25	23.86
2065	5.62	15.20	25.79
2070	6.24	16.60	28.01
2075	7.06	18.69	29.97
2080	7.29	20.39	29.97

† daily mean, maximum or minimum, as applicable, averaged over time period specified
n.b. 2.5th and 97.5th percentile and median values for scenario RCP8.5

1.2.13 No clear trend for change in wind speed during this time period is shown in the regional projections data, with trends leaning towards a decrease in wind speeds in the long term.

Limitations of the analysis

1.2.14 These results were obtained with established climate models, which nevertheless depict a simplified, hence imperfect representation of the evolution of the climate systems in response to natural and anthropogenic forcings. A limited number of climate model simulations were used to derive them; therefore short-term fluctuations can reflect the influence of natural climate variability rather than the response to anthropogenic climate change.

1.3 Climate Risk and Resilience Scoping

1.3.1 Based on the information available for the Project, a high level risk assessment has been undertaken, considering the hazard, potential severity of effect on the development and its users, probability of that effect, and level of influence the development design can have on the risk. The severity of effect score considers the potential consequences of the hazard and the sensitivity of the receptor(s) affected. Each element of the risk assessment has been scored on a scale of one to three, representing low, medium or high; the scores are then summed to give a total risk score. Table 1.8 defines each of these terms.

1.3.2 Given the variability in the nature of the potential effects of climate change on the development, receptors have been identified on a risk-specific basis, whereby all receptors relate to the continued safe and effective operation of the Project. In line with IEMA (2020) guidance, the vulnerability and susceptibility have been considered in determining the severity of risk.

1.3.3 A risk score of five or more has been defined as a risk that could lead to a significant effect of or on the development, prior to mitigation, as this is the minimum score where at least two elements of the risk assessment score are above ‘low’.

1.3.4 By considering the good practice design measures incorporated into the Project, professional judgement is used in determining whether the potentially significant effects would result in significant adverse of beneficial effects.

Table 1-8: Severity, Probability and Influence Factor Definitions

Factor	Score definitions
Severity: the magnitude and likely consequences of the impact should it occur.	**1 =** unlikely or low impact: for example, low-cost and easily repaired property damage; small changes in occupiers' behaviour.
	2 = moderate impacts with greater disruption and/or costs
	3 = severe impact, e.g. risk to individual life or public health, widespread property damage or disruption to business
Probability: reflects both the range of possibility of climatic parameter changes illustrated in CP18 projections and the probability that the possible changes would cause the impact being considered	**1 =** unlikely or low probability of impact; impact would occur only at the extremes of possible change illustrated in projections
	2 = moderate probability of impact, plausible in the central range of possible change illustrated in projections
	3 = high probability of impact, likely even with the smaller changes illustrated as possible in the projections
Influence: the degree to which design of the Project can affect the severity or probability of impacts	**1 =** no or minimal potential to influence, outside control of developer, e.g. reliance on national measures or individuals' attitudes/actions; or hypothetical measures would be impracticable
	2 = moderate potential to influence, e.g. a mixture of design and user behaviour or local and national factors; measures may have higher costs or practicability challenges
	3 = strong potential to influence through measures that are within the control of the developer and straightforward to implement

1.3.5 Table 1-9 shows the climate change risks to the Project that have been identified and the risk scores assigned, following the approach set out in paragraph 1.17 and Table 1.8.

Table 1-9: Risk Scores for the Project

Risk ID	Risk	Severity	Probability	Influence	Total score	Potentially significant?	Embedded mitigation
1	Flooding of the site	Flood risk is assessed in Chapter 7: Water and Hydrology of the EIAR					
2	High temperatures resulting in overheating within buildings, leading to worker health impacts and reduced data centre performance as cooling equipment is overworked.	2	2	2	6	Yes	Passive design measures will minimise excessive solar gain, such as admin areas, housing office spaces and reception areas being north-west and north-east facing to minimise unwanted solar gains. Cooling will be designed to allow for further water storage adjacent to each building, to accommodate higher temperatures if required. Further, the roof of each building will be provided with a reflective finish to improve solar reflectivity.
3	Elevated temperatures may reduce the output capacity of gas-fired combustion turbines.	1	1	2	4	No	Electricity generation by gas turbines will be capable of exceeding the Project's demand, as such the Project should be resilient to decreases in generation capacity of the gas turbines.
4	Structural damage to buildings from extreme weather (storms or snow loads).	2	1	2	5	Yes	Building regulations for structural design with safety margin.
5	High winds leading to damage to cabling resulting in interruptions in power supply.	1	1	1	3	No	Network operators are required to manage and maintain their assets, this would include keeping overhead power lines clear of vegetation for public safety reasons.
6	Increased specific humidity leading to risk of damage to hardware which may in turn impact reliability and life expectancy.	1	1	2	4	No	Air handling units will ensure appropriate recirculation to ensure appropriate humidity within the data centre buildings is maintained.
7	Consistently decreased precipitation resulting in increased occurrence of drought and reduced accessibility to water for water-based cooling method.	1	1	1	3	No	Rainwater harvesting tanks will be installed per data centre to avoid reliance on Irish Water to supply water for mechanical cooling plant. Further, additional water storage could be installed if appropriate, to ensure increased

							resilience to drought and reduced water availability.
8	Ground subsidence as a result of shrinking and swelling of soils due to excessive rainfall and drought may result in damage to cables or gas infrastructure pipework.	1	1	2	4	No	
9	Structural damage to buildings resulting from subsidence caused by drought (shrinking and swelling of soils due to excessive rainfall and drought)	2	1	1	4	No	

1.3.6 The Government of Ireland Sectoral Adaptation Plans (Government of Ireland, 2020) and the Environmental Protection Agency's (EPA) Climate Change Assessment (EPA, 2023) concluded that future risks to the built environment, electricity and gas networks and communications assets are likely to arise from flooding, extreme weather events (in particular high wind speeds) and heightened temperatures. This could result in damage to assets, power failures, asset lifetime, equipment ratings and reduced output of gas-fired combustion turbines. Risks to sub-surface infrastructure, such as the gas transmission network and underground figure cabling, include increased incidence of subsidence and extreme flood events. Overhead copper and fibre lines suspended on poles are the most exposed section of the electronic communications network and as such they are most at risk from extreme storm events and high winds. Overhead cables are also vulnerable to snow, rainfall or even a prolonged growing season, increasing the threat to cables from calling or growing trees. Additionally, extreme weather events may inhibit access to remote infrastructure, delaying possible maintenance or repair work. These risks have the potential to result in cascading failures from the energy and communications sector into other sectors.

1.3.7 The above risks highlighted within the Government of Ireland Sectoral Adaptation Plans (Government of Ireland, 2020) and the Environmental Protection Agency's (EPA) Climate Change Assessment (EPA, 2023) are accounted for within Table 1-9, alongside embedded mitigation measures included within the design of the Project.

1.3.8 The most significant risk from climate change to the Project arises from flooding. This is assessed in Chapter 7: Water and Hydrology and appropriate flood management and resilience measures have been provided.

1.3.9 With the exception of flood risk, the greatest risks to the Project due to climate change have been identified as those arising from extreme weather events resulting in and heightened temperatures impacting performance and potentially damage to structures.

1.3.10 The risks to infrastructure networks such as overhead cable networks are managed by network operators, who have a statutory requirement to keep overhead powerlines clear of vegetation that may increase risk during storms.

1.3.11 Overall, it is considered that the potentially significant risks screened in Table 1.9 do not represent new or unexpected issues, with historic extreme precipitation, drought, fluvial and pluvial flooding, severe windstorm and above average surface temperature events recorded within Kildare historically (Kildare Climate Action Office, 2024). Best practice for the safe operation of electricity generation facilities would mitigate against the likelihood of significant adverse effects thereby reducing the effect to negligible.

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