Appendix 10.3 Inter-Related Effects of Climate Change

10.1 Introduction

10.1.1 This appendix to Chapter 10: Climate Change of the Environmental Statement (ES) assesses the extent to which climate change could exacerbate or ameliorate the effects of the Proposed Development on sensitive receptors (i.e. the inter-related effects of climate change with other environmental impact pathways).

10.1.2 Inter-related effects are effects that interact spatially and/or temporally, resulting in multiple effects, or effects of a greater significance, upon a single receptor. The inter-related effects of climate change can be considered in two categories:

- climate change altering the sensitivity of receptors or the baseline environment, thereby increasing the significance of effects; and,
- climate change modifying an impact pathway, i.e. by changing the magnitude or spatial extent or introducing new receptors.

10.2 Approach to assessment

Policy and guidance

10.2.1 The following legislation and guidance documents have been considered as part of this assessment:

- The Town and Country Planning (Environmental Impact Assessment) Regulations 2017[1];
- Planning Inspectorate Advice Note Nine: Rochdale Envelope, 2018[2]; and
- IEMA Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation, 2020[3].

The Town and Country Planning (Environmental Impact Assessment) Regulations 2017

10.2.2 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 state that:

[1] EIA Regulations, 2017. [Online] Available at: https://www.legislation.gov.uk/uksi/2017/571/contents, last accessed 09/01/2025.

[2] PINS, 2018. [Online] Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advicenotes/advice-note-nine-rochdale-envelope/, last accessed 05/02/2024. This guidance is for nationally significant infrastructure projects but is a relevant statement of good practice that can be applied to any development type, in a proportionate way.

[3] IEMA, 2020. [Online] Available at: https://www.iema.net/resources/reading-room/2020/06/26/iema-eia-guide-to-climatechange-resilience-and-adaptation-2020, last accessed 05/12/2024.

"(2) The EIA must identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of the proposed development on the following factors:

(a) population and human health;

(b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;

(c) land, soil, air, water and climate;

(d) material assets, cultural heritage and the landscape; and

*(e) **the interaction between the factors**4 referred to in sub-paragraphs (a) to (d)." [emphasis added]*

PINS Advice Note Nine

10.2.3 The PINS Rochdale Envelope Advice Note states that an ES should:

*"…ensure that the assessment of the worst case scenario(s) addresses impacts which may not be significant on their own but **could become significant when they inter-relate with other impacts** alone or cumulatively with impacts from other development (including those identified in other aspect assessments)."* [emphasis added]

IEMA EIA Guide to: Climate Change Resilience & Adaptation

10.2.4 With regard to "in-combination" climate impacts (an alternative term for inter-related effects), the guidance states that an ES:

"…need[s] to consider if the impacts of the development on environmental receptors are likely to be different because of the projected future climate conditions compared with the existing baseline conditions. Consideration should also be given to whether completely new effects will arise as a result of the development during construction and/or operation with the future climate conditions".

and additionally:

"…an assessment should be undertaken to identify whether the additional effects of future climate impacts alter the sensitivity and/or magnitude of the effect so that the significance/level of significance of the effects within other topics identified against baseline conditions changes."

Methodology

10.2.5 The assessment has considered how impacts of the Proposed Development, in combination with the effects of climate change, may affect receptors throughout the construction phase and occupational lifetime.

10.2.6 The assessment included the following steps:

- identification of impacts due to the Proposed Development on the present-day environment, as assessed within the applicable ES chapters;
- consideration of how those impacts may be modified by future climate conditions;

- consideration of how the sensitivity or resilience of receptors may be modified by future climatic conditions; and
- an assessment of the potential change in significance of effect on receptors as a result of the above factors

10.2.7 The assessment does not aim to be determinative of significance levels, which have been assessed in the applicable ES topic chapters; but identifies where there is the potential for inter-related effects to increase or decrease the significance of effects reported alone.

10.2.8 The receptors identified can be broadly categorised as follows:

- landscape and visual: designated sites; visual receptors (residents; users of public rights of way (PRoWs); other visual receptors);
- cultural heritage: buried archaeology; designated heritage assets; settings of heritage assets;
- land use, recreation, socio-economics: agricultural land; users of PRoWs and common land; employment levels, housing and other local services;
- ecology: ecologically designated sites; important habitat features; protected species;
- hydrology: surface water bodies; flood risk (residents; other land uses);
- traffic and transport: road users, residents; pedestrians/cyclists; sensitive local uses (e.g. schools, hospitals, local facilities);
- noise and vibration: residents, users of PRoWs; users of other land uses (e.g. places of work);
- air quality: residents; places of public amenity/public attractions; sensitive local uses; species/habitats; and
- health: residents in the local area and future residents of the Proposed Development.

10.3 Future climate baseline

10.3.1 A full future climate baseline is reported in Appendix 10.2: Climate Risk Assessment. To summarise the future climate baseline, it is projected that there will be an increased variability in precipitation trends: precipitation is predicted to decrease during the driest season and increase in the wettest season; but the driest and wettest months may be less so. Temperatures are anticipated to increase annually relative to the 1981-2010 baseline, both during the coldest and hottest seasons and months. Finally, humidity is also expected to increase during both the summer and winter, and hence the annual average will increase.

10.4 Assessment findings

10.4.1 Table 10.1 presents the potential inter-related effects of climate change.

Table 10.1 Inter-related effects of climate change

Climate change effect	Receptor group	Potential for climate change to modify the effect on receptor	Effect on receptor	Mitigation measures	Further information
Drought and increased summer temperatures ('heatwave')	Landscape and visual	The planned landscape planting could fail as a result of increased temperatures and drought conditions in summer months.	Greater adverse impact on visual receptors if planting were to fail.	Consideration of climate resilience (e.g. drought tolerance) in the design and species mix of the landscape planting proposed; a Landscape and Ecological Management Plan with secured aftercare period.	ES Chapter 14: Landscape and Visual
	Air quality	Higher temperatures and increased solar radiation can intensify photochemical reactions, leading to elevated ozone and secondary pollutant levels. Open windows and doors for ventilation during heatwaves may increase indoor exposure to outdoor pollutants. Changes in atmospheric stability and wind patterns may also alter dispersion of emissions.	Greater risk of exceedance of air quality objectives, particularly for NO_2 and PM_{10}, and increased exposure for vulnerable groups.	Implementation of a Travel Plan to reduce reliance on combustion vehicles; promotion of electric vehicle use; dust suppression through damping haul routes, wheel washing, and sheeting of HGVs; real-time monitoring and adaptive dust control.	ES Chapter 7: Air Quality CEMP Section 3.5
	Noise	Elevated temperatures may lead to increased use of natural ventilation (open windows), reducing building envelope attenuation. Combined heat and noise stress may exacerbate cardiovascular and psychological health impacts.	Increased annoyance and health burden from construction and operational noise, particularly for sensitive receptors.	Best Practicable Means (BPM) under CoPA; use of quieter plant and equipment; acoustic screening of generators and pumps; restricted working hours; proactive community liaison and noise monitoring.	ES Chapter 15: Noise CEMP Section 3.3

Climate change effect	Receptor group	Potential for climate change to modify the effect on receptor	Effect on receptor	Mitigation measures	Further information
Drought and increased summer temperatures ('heatwave')	Traffic and transport	Heatwaves may reduce the attractiveness of walking and cycling, increasing reliance on private vehicles. This could lead to higher emissions and congestion, especially during construction.	Increased traffic-related emissions and reduced uptake of active travel modes.	Travel Plan promoting sustainable travel; provision of cycle parking, walking maps, and public transport information; encouragement of car-sharing and use of minibuses for site workers.	ES Chapter 17: Transport and Access CEMP Section 4.9–4.13
	Population & Health	Heatwaves can exacerbate respiratory and cardiovascular conditions, particularly in vulnerable populations. Increased exposure to pollutants and noise during hot weather may compound health risks.	Greater incidence of heat-related illness, respiratory distress, and mental health impacts.	Integrated mitigation across air quality, noise, and transport; targeted health resilience strategies; design of buildings and public realm to support thermal comfort.	ES Chapter 12: Human Health
	Landscape & Visual	Prolonged drought may lead to failure of newly planted vegetation, reducing the effectiveness of landscape mitigation.	Visual degradation and reduced amenity value of public realm.	Use of drought-tolerant species; incorporation of irrigation strategies; Landscape and Ecological Management Plan with long-term aftercare.	ES Chapter 14: Landscape and Visual
	Ecology	Altered phenology and habitat conditions may increase species vulnerability to disturbance and reduce resilience of created habitats.	Greater ecological sensitivity and potential for biodiversity loss.	Habitat design to include structural and species diversity; phased implementation to allow adaptation; ecological monitoring and adaptive management.	ES Chapter 11: Ecology

Climate change effect	Receptor group	Potential for climate change to modify the effect on receptor	Effect on receptor	Mitigation measures	Further information
Drought and increased summer temperatures ('heatwave')	Water Environment	Increased demand for potable water and reduced availability during droughts may stress water supply systems and aquatic habitats.	Potential deterioration in waterbody status and ecological function.	Water-efficient fittings; rainwater harvesting; early implementation of SuDS; temporary surface water management during construction.	Climate Change Statement; CEMP Section 3.24–3.34
Winter storm and extreme weather events	Transport	Flooding and storm events may disrupt construction access routes and reduce resilience of the local road network.	Delays, safety risks, and increased emissions from idling or rerouted vehicles.	Use of robust haul routes; flood alerts integrated into site management; temporary drainage and bunding; phased construction access planning.	ES Chapter 17: Transport and Access; CEMP Sections 2.18–2.25, 3.16–3.25
	Noise	Increased use of pumps and generators during storm events may elevate background noise levels.	Potential exceedance of noise thresholds and increased disturbance.	Acoustic screening of temporary plant; adaptive noise control; liaison with residents during high-impact periods.	ES Chapter 15: Noise; CEMP Section 3.3
	Air Quality	Windy and dry storm conditions can increase dust mobilisation and pollutant dispersion.	Greater risk of nuisance dust and exposure for nearby receptors.	Dust suppression protocols; silt fencing; no discharge of contaminated water; wheel washing and road sweeping; real-time monitoring.	ES Chapter 7: Air Quality; CEMP Sections 3.5–3.6
	Landscape & Visual	Intense rainfall and dry spells may lead to soil erosion, undermining landscape establishment.	Visual degradation and increased maintenance burden.	Ground-cover planting; erosion control measures; adaptive landscape management.	ES Chapter 14: Landscape and Visual

10.5 Summary and conclusion

10.5.1 This appendix has considered the potential for the environmental pathways identified within applicable ES chapters to interact and combine with the effects of climate change during the construction phase and occupational lifetime of the Proposed Development.

10.5.2 Climate change is likely to impact receptors in two main ways: through drought and increased summer temperatures, and through winter storm and extreme weather events. The assessment of interrelated climate change effects on receptors has identified a range of potential pathways through which future climatic conditions may exacerbate environmental impacts associated with the Proposed Development. These effects are particularly relevant during both the construction and operational phases, and have been considered in relation to air quality, noise, transport, landscape, ecology, water environment, and public health.

10.5.3 Key findings include:

- Air Quality: Elevated temperatures and changing weather patterns may intensify pollutant dispersion and photochemical reactions, increasing the risk of exceedance of air quality objectives. Construction-phase dust and emissions are particularly sensitive to dry and windy conditions. Mitigation measures such as dust suppression, wheel washing, and promotion of low-emission transport modes are embedded within the CEMP and ES Chapter 7.

- Noise: Climate change may increase receptor sensitivity to noise due to greater reliance on natural ventilation (open windows) during heatwaves. Combined heat and noise stress may exacerbate health impacts. The CEMP outlines Best Practicable Means (BPM) for noise control, including acoustic screening, equipment silencers, and restricted working hours, as detailed in ES Chapter 15.

- Transport: Extreme weather events, including heatwaves and winter storms, may reduce the resilience of the transport network and affect travel behaviour. The Construction Travel Plan promotes sustainable travel and includes contingency routing and access strategies to maintain connectivity during adverse conditions, as set out in ES Chapter 17 and CEMP Sections 2.18–2.25.

- Landscape and Visual: Drought and intense rainfall may compromise the success of landscape planting and increase erosion risks. The Landscape and Ecological Management Plan includes species selection for climate resilience and erosion control strategies, as referenced in ES Chapter 14.

- Ecology: Seasonal shifts and habitat stress may alter species sensitivity and reduce ecological resilience. The ES and CEMP include habitat diversification and adaptive management measures to support long-term ecological integrity.

- Water Environment: Drought conditions may reduce water availability and increase abstraction pressures, while storm events pose flood and pollution risks. The CEMP includes temporary drainage, bunding, silt fencing, and water efficiency measures to mitigate these risks, in line with the Climate Change Statement and ES Chapter 13.

- Population and Health: Vulnerable groups may experience heightened health risks due to combined environmental stressors. Integrated mitigation across air quality, noise, and transport supports public health resilience, as outlined in ES Chapter 12.

10.5.4 The Proposed Development has embedded a robust suite of mitigation measures within its design and construction strategy to address the potential exacerbation of environmental effects due to climate change. These measures are proportionate, evidence-based, and

aligned with best practice guidance. The Construction Environmental Management Plan provides a dynamic framework for managing climate-sensitive impacts during the build-out period, with flexibility to adapt to evolving conditions and stakeholder feedback.

10.5.5 The assessment concludes that, with the implementation of the identified mitigation measures, the interrelated effects of climate change on receptors can be effectively managed, and residual impacts are not anticipated to be significant.