Statutory Consultation 2022

Preliminary Environmental Information Report

Volume 2: Main Report

Chapter 9: Climate Change Resilience

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9 CLIMATE CHANGE RESILIENCE

9.1 Introduction

9.1.1 This chapter presents the preliminary assessment of likely significant effects of climate change impacts on the Proposed Development described as the Climate Change Resilience (CCR) assessment and the combined impacts of climate change and the Proposed Development on receptors in the surrounding environment (known as the In-combination Climate Change Impacts (ICCI) assessment). An assessment of Greenhouse Gas Emissions (i.e. the impact of the Proposed Development on climate change) is presented in **Chapter 12** Greenhouse Gases in Volume 2 of this PEIR.

9.1.2 The Environmental Impact Assessment (EIA) Scoping Report sets out the proposed scope for the assessment of climate change. In summary, the following have been assessed in this Preliminary Environmental Information Report (PEIR):

a. The CCR assessment focuses on the resilience of the Proposed Development to projected future climate change effects. An example of this would be if increased intensity of extreme precipitation events leads to increased volumes of surface water run-off overwhelming the drainage infrastructure.

b. The ICCI assessment focuses on those effects of the Proposed Development identified by other environmental assessments in this PEIR that will be exacerbated by climate change. For example, an increase in duration of dry spells leading to increase in dust production and poor air quality during construction. This may impact communities near the airport if not managed.

9.1.3 The remainder of this chapter consists of:

a. **Section 9.2** Legislation, policy and guidance relevant to the scope and methodology of the Climate Change Resilience preliminary assessment;

b. **Section 9.3** Scope of the assessment;

c. **Section 9.4** Stakeholder engagement undertaken to inform the preliminary assessment;

d. **Section 9.5** Methodology applied to the preliminary assessment;

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k. **Section 9.12** Monitoring;

l. **Section 9.13** Assessment summary; and

m. **Section 9.14** Completing the assessment - remaining work to complete the EIA for the Environmental Statement.

9.2 Legislation, policy and guidance

9.2.1 This section identifies the key legislation, policy and guidance relevant to the scope and methodology for the Climate Change Resilience assessment and which may influence the type of mitigation measures that could be incorporated into the Proposed Development during construction and operation.

9.2.2 **Table 9.1** to **Table 9.4** provide a description of the relevant legislation, policy and guidance, and where each of these have been addressed in the PEIR.

Legislation

Table 9.1: Climate Change Resilience legislation

Legislation	How and where addressed in PEIR
Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Ref. 9.1) Requires a description of the factors likely to be significantly affected by the development including climate (for example impacts relevant to adaptation) (Schedule 4 (Para 4(4))), and a description of the likely significant effects of the vulnerability of the project to climate change" (Schedule 4 (para 5(f)).	Likely significant effects of the vulnerability of the project to climate change with the embedded and good practice mitigation measures are presented in the **Section 9.9** and **Table 9.26** and **Table 9.27**.
Climate Change Act 2008 (amended 2019) (Ref. 9.2) Requires infrastructure operators and public bodies to report on how they are addressing the impacts of climate change on their organisation under the Adaptation Reporting Power. London Luton Airport Operations Ltd (LLAOL) published a Climate Change Adaption Report in May 2011. A revised Climate Change Adaption Report is due to be published in 2021 as part of the third round of adaptation reporting.	As the revised 2021 Climate Change Adaptation Report is not yet available, LLAOL's 2011 Climate Change Adaptation Report has been used to inform the CCR assessment, including the methodology set out in **Section 9.5**.

Policy

Table 9.2: Climate Change Resilience policy

Policy	How and where addressed in PEIR
National Planning Policy Framework (NPPF) (2021) (Ref. 9.3) The NPPF requires all plans to mitigate climate change (including by making effective use of land in urban areas) and adapt to its effects.	The approach outlined in the NPPF to decrease vulnerability to current and future impacts of climate change and flood risk has been applied using the latest climate projections data from UKCP18. Embedded and good practice adaptation measures have been identified in **Section 9.8** and **Table 9.26** and **Table 9.27.**
National Policy Statement for National Networks – December 2014 (NPSNN) (Ref. 9.4) The NPSNN sets out the need for, and Government's policies to deliver, development of nationally significant infrastructure projects on the national road and rail networks in England. It provides planning guidance for promoters of nationally significant infrastructure projects (NSIP) on the road and rail networks. The provisions of the NPSNN relevant to environmental assessment broadly mirror those as outlined in the ANPS.	There are no elements of the Proposed Development that would be classified as a NSIP on the national road or rail network. However, the NPSNN remains a relevant consideration as works are proposed on the SRN at Junction 10 as part of the Proposed Development. As provisions relevant to environmental assessment broadly mirror those as outlined in the ANPS they have been appropriately considered in this preliminary assessment. Further consideration of the proposals against relevant NPSNN policies will take place following this consultation and in preparation of the application for development consent.
National Planning Policy Guidance: Flood Risk and Coastal Change (Ref. 9.5) The Flood Risk and Coastal Change guidance within the National Planning Practice Guidance (NPPG) contains climate change allowances to be included in flood risk assessments.	These allowances have been considered as part of the design as outlined in **Section 9.8** and **Table 9.27.**
A Green Future: Our 25 Year Plan to Improve the Environment, 2018, updated 2019 (Ref. 9.6) The 25 Year Plan outlines objectives to reduce risk of harm from environmental hazards such as flooding and drought and mitigating and adapting to climate change.	Measures to reduce the vulnerability of the Proposed Development to climate change are set out in **Section 9.8** and **Table 9.26** and **Table 9.27**.
Luton Borough Council (LBC) Local Plan 2011-2031(Ref. 9.7)	Measures to minimise the risk of flooding and other climate change risks are set out

Policy	How and where addressed in PEIR
The Local Plan outlines the threats faced as a result of flooding and other climate change risks, and mitigation strategies that need to be considered during the design of new developments.	in **Section 9.8** and **Table 9.26** and **Table 9.27**.
Luton Borough Council (LBC) Climate Change Adaptation Action Plan (Ref. 9.8) The Action Plan sets out a number of measures that need to be considered during the design and operation of the new developments.	These have been considered in **Section 9.8** and **Table 9.26** and **Table 9.27** to increase the Proposed Development's resilience to climate change.
Luton Borough Council (LBC) Climate Change Action Plan 'My climate action plan. Becoming a carbon neutral borough by 2040' (Ref. 9.9) The Action Plan sets out actions to support climate change adaptation related to flooding and resilience.	These have been incorporated into the measures outlined in **Section 9.8** and **Table 9.26** and **Table 9.27** to increase the Proposed Development's resilience to climate change.
Central Bedfordshire Council (CBC) Local Plan 2015 – 2035 (Ref. 9.10) The Local Plan includes policies on making developments resilient to the impacts of increased flooding, drought, and overheating, and managing risks through good design.	Measures to increase the Proposed Development's resilience to climate change are set out in **Section 9.8** and **Table 9.26** and **Table 9.27**.
North Hertfordshire District Council (NHDC) Proposed Submission Draft Local Plan for 2011-2031(Ref. 9.11) The Local Plan requires consideration to be given to addressing climate change resilience impacts.	Consideration of climate change impacts on the Proposed Development are outlined in **Section 9.9** and **Table 9.26** and **Table 9.27**. Measures to increase the Proposed Development's resilience to climate change are set out in **Section 9.8** and **Table 9.26** and **Table 9.27**.

9.2.3 The Airports National Policy Statement (ANPS) (Ref. 9.12) does not have effect in relation to an application for development consent for an airport development not comprised of an application relating to the Heathrow Northwest Runway. Nevertheless, as set out within paragraph 1.41 of the ANPS, the Secretary of State considers that the contents of the ANPS will be both important and relevant considerations in the determination of such an application, particularly where it relates to London or the south east of England.

9.2.4 Accordingly, whilst the ANPS does not have effect in relation to the Proposed Development, it will be an important and relevant consideration in the determination of Luton Rising's (the Applicant) application for development consent. A summary of the relevant provisions for the Climate Change Resilience assessment and how these have been addressed in this PEIR is provided within **Table 9.3**.

Table 9.3: How relevant Climate Change Resilience requirements of ANPS are addressed in the PEIR

ANPS Section	How and where addressed in PEIR
Paragraph 4.45 "*New airports infrastructure will typically be a long-term investment which will need to remain operational over many decades, in the face of a changing climate. Consequently, the applicant must consider the impacts of climate change when planning design, build and operation*."	The impacts of climate change on the Proposed Development are considered within this PEIR chapter and have been throughout the sifting and optioneering planning stages as presented in **Chapter 3** Assessment of Alternatives in Volume 2 of this PEIR. The CCR assessment covered in this chapter covers design, build (construction) and operation.
Paragraph 4.46 "*Detailed consideration must be given to the range of potential impacts of climate change using the latest UK Climate Projections available at the time, and to ensuring any environmental statement that is prepared identifies appropriate mitigation or adaptation measures. This should cover the estimated lifetime of the new infrastructure*"	The assessment methodology outlined in this PEIR includes identification of climate change impacts using UKCP18 (the latest set of UK climate projections) reflecting a number of time periods, covering the lifetime of the Proposed Development, as described in **Section 9.5** of this chapter. **Section 9.8** and **Table 9.26** and **Table 9.27** set out how embedded environmental measures will be implemented in relation to climate change.
Paragraph 4.47 "*Where transport infrastructure has safety-critical elements, and the design life of the asset is 60 years or greater, the applicant should apply the latest available UK Climate Projections, considering at least a scenario that reflects a high level of greenhouse gas emissions at the 10%, 50% and 90% probability levels, to assess the impacts of climate change over the lifetime of the development*"	The assessment has considered a scenario that reflects a high level of greenhouse gas emissions at the 10%, 50% and 90% probability levels to assess the impact of climate change over the lifetime of the Proposed Development. For this reason, Representative Concentration Pathway (RCP) 8.5[1], as described in **Section 9.5** has been used. RCP 8.5 is the highest emissions scenario available on UKCP18 representing a global temperature increase of approximately 4.3˚C by 2100, relative to pre-industrial temperatures.

[1] UKCP18 uses a range of possible scenarios, classified as RCPs, to inform differing future emission trends. These RCPs specify the concentrations of greenhouse gases that will result in total radiative forcing increasing by a target amount by 2100, relative to preindustrial levels.

ANPS Section	How and where addressed in PEIR
Paragraph 4.48 "*The applicant should demonstrate that there are no critical features of infrastructure design which may be seriously affected by more radical changes to the climate beyond those projected in the latest set of UK Climate Projections. Any potential critical features should be assessed, taking account of the latest credible scientific evidence on, for example, sea level rise, and on the basis that necessary action can be taken to ensure the operation of the infrastructure over its estimated lifetime through potential further mitigation or adaptation*"	In line with the ANPS, more radical changes to the climate beyond those projected in the latest set of UKCP18 have been considered in the PEIR using plausible higher and lower end climate change projections from both the H++/L-- scenarios, and the UKCP18 probabilistic projections of climate extremes (PPCE).
Paragraph 4.49 *"Any adaptation measures should be based on the latest set of UK Climate Projections, the most recent UK Climate Change Risk Assessment, consultation with statutory consultation bodies, and any other appropriate climate projection data. Any adaptation measures must themselves also be assessed as part of any Environmental Impact Assessment and included in the environmental statement, which should set out how and where such measures are proposed to be secured."*	The consideration of the UK Climate Change Risk Assessment in the methodology is described in **Section 9.5** of this chapter. **Section 9.3** sets out the responses to comments received from Planning Inspectorate (PINS) via the Scoping Opinion. **Section 9.4** outlines engagement with statutory consultation bodies and other key stakeholders. Mitigation measures have been developed to manage risks. These are described in **Section 9.8.**
Paragraph 4.50 *"If any proposed adaptation measures themselves give rise to consequential impacts, the Secretary of State will consider the impact in relation to the application as a whole and the assessment principles set out in the Airports NPS."*	No consequential environmental impacts have been identified as a result of proposed adaptation measures.
Paragraph 4.51 *"Adaptation measures can be required to be implemented at the time of construction where necessary and appropriate to do so."*	Adaptation measures have been incorporated into the design of the Proposed Development to be constructed. Adaptation/mitigation measures during construction have been identified in **Section 9.8** and **Table 9.26** and **Table 9.27**.
Paragraph 4.52 *"Where adaptation measures are necessary to deal with the impact of climate change, and that measure would*	Adaptation measures to be incorporated throughout the operational lifetime of the Proposed Development are set out In **Section 9.8** and **Table 9.26, Table 9.27**.

ANPS Section	How and where addressed in PEIR
have an adverse effect on other aspects of the project or the surrounding environment, the Secretary of State may consider requiring the applicant to ensure that the adaptation measure could be implemented should the need arise, rather than at the outset of the development."	

Guidance

Table 9.4: Climate Change Resilience guidance

Legislation	How and where addressed in PEIR
Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (Ref. 9.13) This provides a framework for the effective consideration of climate change resilience and adaptation in the EIA process.	The IEMA guidance has been used to define the CCR and ICCI assessments, including: a. the identification of Proposed Development assets and receptors potentially vulnerable to climate change set out in **Section 9.3**; b. the assessment methodology outlined in **Section 9.5**; and c. the existing and future baseline for climate parameters defined in **Section 9.7**.
International Civil Aviation Organisation's (ICAO) Environmental Report 2010 Chapter 6: Adaptation (Ref. 9.14) This provides further context of climate change mitigation and adaptation within the aviation industry	This has been used to inform relevant adaptation measures in **Section 9.8**.
Civil Aviation Authority (CAA) 2015 Climate Change Adaptation Report (Ref. 9.15) This highlights the direct impacts of climate change on the aviation sector, reviews performance of adaption across the UK's regulated airports.	This has been used to inform the potential risks of climate change on the proposed development presented in **Section 9.9** and in **Table 9.26** and **Table 9.27.**
The Committee on Climate Change's (CCC) Technical Report of the Third UK Climate Change Risk Assessment (CCRA3) (Ref. 9.16) The Committee on Climate Change's (CCC) UK Climate Change Risk	This has been used to help identify the potential CCR impacts outlined in **Section 9.9**.

Legislation	How and where addressed in PEIR
Assessment Evidence Report provides further context of climate risks and mitigation and adaptation measures within the aviation industry.	
The Airport Cooperatives Research Programme's (ACRP) Climate Change Adaptation Planning: Risk Assessment for Airports (Ref. 9.17) This provides further context for climate change projections and impacts for airports.	This has been used to inform the potential risks of climate change on the Proposed Development presented in **Section 9.9** and in **Table 9.26** and **Table 9.27.**

9.3 Scope of the assessment

9.3.1 This section describes the scope of the Climate Change assessment, including how the assessment has responded to the Scoping Opinion. The temporal and spatial scope, the relevant receptors, and matters scoped in and out are identified. A description of engagement undertaken with relevant technical stakeholders to develop and agree this scope is provided in **Section 9.4**.

Scoping Opinion

9.3.2 The EIA Scoping Report sets out the proposed scope and assessment methodologies to be employed in the EIA and is provided in **Appendix 1.1** of Volume 3 to this PEIR.

9.3.3 In response to that Scoping Report, a Scoping Opinion was received from PINS on 9 May 2019 and is provided in **Appendix 1.3** in Volume 3 of this PEIR.

9.3.4 **Table 9.5** describes the main matters highlighted by PINS in the Scoping Opinion and how these have been addressed in this PEIR. Final responses to all comments received during Scoping will be provided in an appropriate format in the ES.

Table 9.5: Climate Change Resilience Scoping Opinion comments

Scoping Opinion ID	Scoping Opinion comment	How is this addressed
3.2.17	The ES should include a description and assessment (where relevant) of the likely significant effects the Proposed Development has on climate (for example having regard to the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change. Where relevant, the ES	An assessment of the likely significant effects the Proposed Development has on climate (for example having regard to the nature and magnitude of greenhouse gas emissions) is covered in **Chapter 12** Greenhouse Gases in Volume 2 of this PEIR.

Scoping Opinion ID	Scoping Opinion comment	How is this addressed
	should describe and assess the adaptive capacity that has been incorporated into the design of the Proposed Development. This may include, for example, alternative measures such as changes in the use of materials or construction and design techniques that will be more resilient to risks from climate change.	An assessment of vulnerability is included in this PEIR chapter in **Section 9.9**. Embedded and good practice mitigation measures including the adaptive capacity to make the Proposed Development more resilient to risks from climate change are set out in **Section 9.8**. and **Table 9.26** and **Table 9.27**.
4.3.3	The Applicant should ensure that other consultation bodies with statutory responsibilities for other matters relevant to this aspect assessment (e.g. biodiversity), such as Natural England, are consulted regarding the potential for climate change effects to influence the effectiveness of any proposed mitigation measures.	Consultation requests to statutory bodies such as Natural England have been submitted. Proposed meetings include discussions about the potential for climate change effects to influence the effectiveness of any proposed mitigation measures and information gathered will be used to inform the ES. Consultation on climate change has been meetings with the Environment Agency and Lead Local Flood Authorities, the drainage team have confirmed the use of a 40% climate change allowance within the design to account for future impacts of climate change. In addition, the drainage team have been leading on discussions with Thames Water and Affinity Water and conversations with Affinity Water have been focused on water resource availability which have considered the future impacts of climate change on water resources in Luton and how mitigation measures embedded in the Drainage Design Statement (such as water reuse and rainwater harvesting) will help to minimise the impact of the project on local water resource availability.
4.3.4	The ES should set out the assumptions and uncertainties in the projections and explain how these have informed the climate change	The assumptions and uncertainties in this assessment are set out in **Section 9.6,** including how these have informed the CCR assessment

Scoping Opinion ID	Scoping Opinion comment	How is this addressed
	risk and resilience assessment and influenced the design of the Proposed Development.	and influenced the design of the Proposed Development.
4.3.5	The ES should set out how mitigation measures will be secured through the DCO and how the adaptation measures described, and those incorporated into the Climate Change Adaptation Plan, will address the need for on-going review of climate 'hazards' and risks.	Likely mitigation measures and how they will be secured through the Development Consent Order (DCO) is set out in **Table 9.26** and **Table 9.27**.
4.3.6	The ES should include a description and assessment (where relevant) of the likely significant effects the Proposed Development has on climate (for example having regard to the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change. Where relevant, the ES should describe and assess the adaptive capacity that has been incorporated into the design of the Proposed Development. This may include, for example, alternative measures such as changes in the use of materials or construction and design techniques that will be more resilient to risks from climate change.	An assessment of the assessment of the likely significant effects the Proposed Development has on climate (for example having regard to the nature and magnitude of greenhouse gas emissions) is covered in **Chapter 12** Greenhouse Gases. An assessment of vulnerability is included in this ES chapter in **Section 9.9**.

9.3.5 Embedded and good practice mitigation measures including the adaptive capacity to make the Proposed Development more resilient to risks from climate change are set out in **Section 9.8** and **Table 9.26** and **Table 9.27.** This was accepted in PIN's Scoping Opinion.

9.3.6 The ICCI assessment considers all identified effects (including those identified by the Cumulative Effects Assessment (CEA)) and whether these are exacerbated by climate change. The Zone of Influence (ZOI) is therefore defined by other environmental topics.

Temporal Scope

9.3.7 The Proposed Development will be delivered over two key delivery phases (Phase 1 and Phase 2 (assessed in two parts 2a and 2b), within which construction and operation may take place simultaneously. Assessment years

for each phase are described in **Chapter 5** Approach to the Assessment in Volume 2 of this PEIR.

9.3.8 The temporal scope of both the CCR and ICCI assessments is the 60-year project design life, from the start of construction through to the end of the design life.

9.3.9 Construction works are planned to commence in 2024 and activities will be phased up to 2040. The 2020-2049 (2030's) time period (see **paragraph 15.4.19** below) is used for construction activities for both the ICCI and CCR assessments to represent a reasonable worst case approach.

9.3.10 For the assessment of effects during operation, two time-periods have been selected (2040-2069 and 2070-2099) to understand potential medium-term and long-term impacts up to the end of the 21st century. Assessment of climate extremes is only considered up to 2079 in line with available UKCP18 regional land projections data.

Receptors

9.3.11 Receptors scoped into the assessment are listed in the **Table 9.6** and **Table 9.7.**

Matters scoped in

Climate change resilience

9.3.12 The scope of the CCR assessment considers the risks of the Proposed Development to the impacts of climate change from construction up to the end of its design life. **Table 9.6** sets out the assets of the Proposed Development scoped into the CCR assessment.

Table 9.6: Receptors into the CCR assessment

Phase	Receptor
Construction	Materials and equipment required for the construction of all built assets
	Structures
	Staff facilities
	Access routes to construction sites
	Workers on construction sites
Operation	Luton Direct Air-Rail Transit (Luton DART) extension to the new terminal
	Additional taxiways and aircraft stands

Phase	Receptor
	Terminal 1 extension, new Terminal 2, and associated buildings, including airside facilities, and other supporting buildings such as, office buildings, police station, hotels, logistics centre and technical service buildings, including end users such as staff and passengers
	Fire training ground
	Cargo and catering facility
	Highway network improvements, including the new Airport Access Road (previously referred to as the Century Park Access Road), car parking facilities, bus, coach and taxi facilities and airside roads
	Drainage and pollution control assets (sewage and effluent treatment plants)
	Fuel farm
	Flood attenuation and storage infrastructure i.e. water infiltration (soakaway) and attenuation tanks, fire, water and energy storage assets
	De-icing storage facility
	Public open space and amenities
	Energy centre
	Aircraft operations (activities associated with aircraft operations during the landing and take-off cycle i.e. taxi, take off, climb and approach)
	Landform and earthworks
	Landscaping
	Operational workers

In-combination climate change impacts

9.3.13 The ICCI assessment considers the extent to which climate change exacerbates effects on aspect receptors which have already been identified in the other discipline chapters. The scope of and receptors identified for the ICCI assessment are outlined in **Table 9.7.**

Table 9.7: Receptors scoped into the ICCI assessment

Discipline	Receptors
Agricultural Land Quality and Farm Holdings (**Chapter 6** in Volume 2 of this PEIR)	Soil resources and impact on farming operations.
Air Quality (**Chapter 7** in Volume 2 of this PEIR)	Residential and other properties, and designated habitats.
Biodiversity (**Chapter 8** in Volume 2 of this PEIR)	Terrestrial and freshwater habitats, including the species present within them.
Cultural Heritage (**Chapter 10** in Volume 2 of this PEIR)	Cultural heritage assets, including Someries Castle, archaeological remains and the historic landscape.
Economics and Employment (**Chapter 11** in Volume 2 of this PEIR)	Local businesses, local labour force and the broader economy.
Greenhouse Gases (**Chapter 12** in Volume 2 of this PEIR)	The global climate.
Health and Community (**Chapter 13** in Volume 2 of this PEIR)	Community assets and community and health effects on the people.
Landscape and Visual (**Chapter 14** in Volume 2 of this PEIR)	Landscape and townscape characteristics and settings, including residential amenity, viewpoints and recreational routes.
Noise and Vibration (**Chapter 16** in Volume 2 of this PEIR)	Residents in terms of individual dwellings and on a wider community basis, including community open areas, and community facilities.
Soils and Geology (**Chapter 17** in Volume 2 of this PEIR)	Surface and ground resources, workers within construction sites, users of the future development or at adjacent land or property, and the built environment.
Water Resources and Flood Risk (**Chapter 20** in Volume 2 of this PEIR)	Groundwater and surface waterbodies, existing water infrastructure as defined by the aspect, flood risk receptors surrounding the Proposed Development.

9.3.14 The ICCI assessment has been deemed as not relevant for following technical disciplines:

a. **Chapter 15** Major Accidents and Disasters in Volume 2 of this PEIR: as consideration of climate change is included as part of the natural hazards assessment. It is noted that although similar risks are considered, both use a different approach to assess these risks.

b. **Chapter 18** Traffic and Transportation in Volume 2 of this PEIR: as the impacts of climate change to relevant transportation networks e.g. connecting roads and the Luton DART have been considered as part of the CCR assessment or identified through the ICCI assessments for other disciplines. For example, with warmer days, householders may be

more likely to have windows open and therefore be more aware of traffic noise or to have car fumes entering the residence.

c. **Chapter 19** Waste and Resources in Volume 2 of this PEIR: as for the receptors (waste management infrastructure and national material resources demand), it is assumed that impacts arising from climate change on the operation of waste management infrastructure and manufacturing of material resources are considered as part of the planning and permitting process for such facilities.

Matters scoped out

9.3.15 As agreed in the Scoping Opinion, the following aspects of the CCR and ICCI assessments have been scoped out:

a. Impacts of sea level rise have been scoped out of the CCR and ICCI assessments as the Proposed Development is not within the geographical proximity of the coast.

b. Due to the length of the lifetime of the Proposed Development, decommissioning of the airport will not be considered within the scope of the assessment. Any future decommissioning of the airport is likely to require planning consent and a separate assessment.

9.4 Stakeholder engagement and consultation

9.4.1 Engagement and consultation in relation to the vulnerability of the Proposed Development to climate change has been undertaken with a number of prescribed and non-prescribed stakeholders. Engagement and consultation on the climate change resilience assessment has been completed through the following:

a. by PINS in their consideration of the Scoping Report and adoption of the Scoping Opinion (refer to Appendices 1.1, 1.2 and 1.3 of Volume 3 of the ES);

b. non-statutory and statutory consultation, where comments relevant to the climate change assessment were received as part of the joint response issued by WSP on behalf of Luton Borough Council (LBC), Central Bedfordshire Council (CBC), North Hertfordshire District Council (NHDC) and Hertfordshire County Council (HCC); and

c. meetings with the Climate Change and Greenhouse Gases stakeholder working group.

9.4.2 The Climate Change and Greenhouse Gases stakeholder working group comprises representatives from:

a. Buckinghamshire County Council;

b. CBC;

c. Dacorum Borough Council;

d. East Herts and Stevenage Council;

e. LBC;

f. Milton Keynes Council; and

g. NHDC.

9.4.3 The invitation to participate in the Climate Change and Greenhouse Gas working group was extended to all host authorities, however at present only includes representatives from those listed above.

9.4.4 The **2019 Statutory Consultation Feedback Report** contains a full account of the previous statutory consultation process and issues raised in feedback. No significant matters were raised regarding the scope, method or mitigation considered as part of the Climate Change Resilience assessment.

9.4.5 **Table 9.8** provides a summary of engagement with relevant stakeholders, undertaken to inform the EIA to date, including the date and time of meetings and a summary of discussions to resolve matters raised.

Table 9.8: Stakeholder engagement relating to Climate Change Resilience

Meeting name and date	Attendees (organisation)	Summary of discussion
Climate change and greenhouse gas	Buckinghamshire County Council	Overview of CCR and ICCI methodologies and

Meeting name and date	Attendees (organisation)	Summary of discussion
working group – meeting no 1. (18 March 2021)	CBC Dacorum Borough Council East Herts and Stevenage Council LBC NHDC	mitigation/adaptation measures presented. No issues with approach to CCR or ICCI assessments raised. Main focus of the discussion was on the GHG assessment.
Climate change and greenhouse gas working group – meeting no 2. (4 November 2021)	Buckinghamshire County Council CBC Dacorum Borough Council East Herts and Stevenage Council LBC Milton Keynes Council NHDC	Preliminary findings of 2022 PEIR presented. No issues on CCR or ICCI assessments raised. Main focus of the discussion was on the GHG assessment.

9.4.6 Stakeholder engagement will continue as the Proposed Development progresses and will include further meetings with the Climate Change and Greenhouse Gases working group to discuss next steps for the ES.

9.5 Methodology

Overview

9.5.1 This section outlines the methodology employed for assessing the likely significant effects of climate change on the construction and operation of the Proposed Development and the combined impacts of climate change and the Proposed Development on receptors in the surrounding environment.

Baseline methodology

9.5.2 Baseline data has been collected through desk-based research for the study area as described in **Section 9.3** in line with relevant policy and legislation.

Existing baseline

9.5.3 The existing baseline for the CCR and ICCI assessments is the current climate as defined in terms of temperature, rainfall, and other climatic factors.

9.5.4 Existing baseline data gathered for the CCR and ICCI assessments has been focused on assembling information on current climatic conditions for the location of the Proposed Development.

9.5.5 Data has been sourced from:

a. UK Climate Projections (UKCP18) (Ref. 9.18);
b. the Met Office observational data for the station nearest to the airport (Ref. 9.19); and
c. LLAOL Climate Change Adaptation Report (Ref. 9.20).

Future baseline

9.5.6 UKCP18 (Ref. 9.21) provides probabilistic climate change projections for annual, seasonal and monthly changes to mean climatic conditions over land areas, i.e. probabilistic changes in future climate based on an assessment of model uncertainties.

9.5.7 For the purpose of this assessment, UKCP18 (Ref. 9.22) probabilistic projections for pre-defined 30-year periods for the following average climate variables have been obtained and analysed:

a. mean annual temperature;
b. mean Summer temperature;
c. mean Winter temperature;
d. maximum Summer temperature;
e. minimum Winter temperature;
f. mean annual precipitation;
g. mean Summer precipitation;
h. mean Winter precipitation;

i. annual specific humidity;

j. Summer specific humidity; and

k. Winter specific humidity.

9.5.8 Further data has been obtained from the UKCP18 regional land projections dataset for other climate variables and extreme weather events, including:

a. annual number of heatwaves (2 days with maximum temperature higher than 29°C and minimum temperature higher than 15°C);

b. annual number of frost days (less than 0°C);

c. annual number of days with 'heavy rain' (precipitation higher than 25mm/day);

d. annual number of dry spells (10 or more consecutive days without precipitation (defined as 0.2mm); and

e. Summer highest daily maximum temperature (ºC).

9.5.9 Future baseline data has been collected for RCP 8.5 which is the highest emissions scenario available on UKCP18 representing a global temperature increase of approximately 4.3˚C by 2100, relative to pre-industrial temperatures.

9.5.10 The approach to defining future baseline is described in **Section 5.4** of **Chapter 5** in Volume 2 of this PEIR. The future baseline considered for Climate Change Resilience is described **Section 9.7** of this Chapter.

Construction and operation assessment methodology

9.5.11 The approach outlined below is aligned with existing guidance as referenced in **Table 9.4** and good practice from similar studies.

9.5.12 The following key terms and definitions relating to the CCR and ICCI assessment are used:

a. **Climate hazard** – a weather or climate related event which has potential to do harm to environmental or community receptors or assets, for example increased winter precipitation.

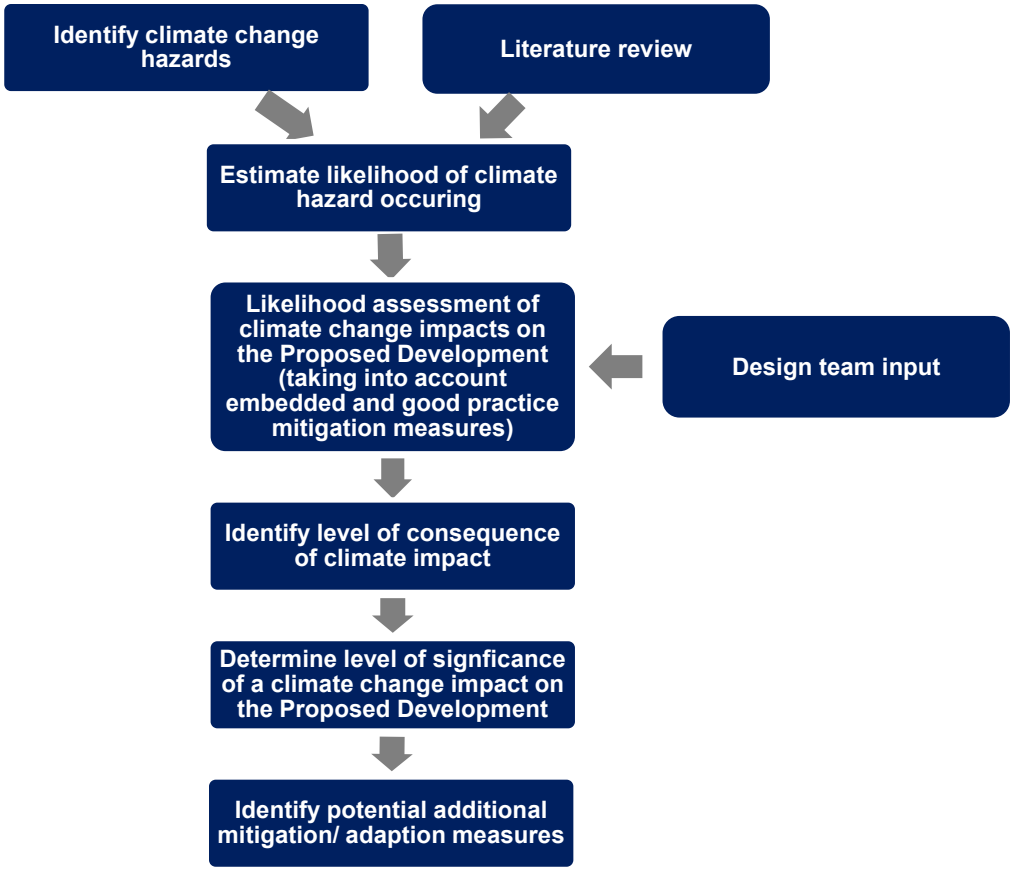
b. **Climate change impact** – an impact from a climate hazard which affects the ability of the receptor or asset to maintain its function or purpose.

c. **Consequence** – any effect on the receptor or asset as a result of the climate hazard having an impact.

Climate change resilience

9.5.13 The methodology applied for the CCR assessment, as outlined in **Inset 9.1** uses a combination of quantitative information on climate change projections and qualitative information related to potential impacts.

Inset 9.1: CCR assessment methodology flow diagram



Identifying climate change hazards

9.5.14 Existing literature provided information on climate change such as the third UK Climate Change Risk Assessment (Ref. 9.23) along with UKCP18 data outputs for the location of the Proposed Development has been used to identify potential climate hazards that may affect the geographical location of the Proposed Development.

Likelihood of climate change hazard occurring

9.5.15 Once climate change hazards were identified, the likelihood of the climate change hazard occurring has been assessed. The likelihood of a climate change hazard occurring is defined as the probability of some well-defined outcome occurring in the future. Likelihood is categorised into five levels depending on the probability of the hazard occurring, in line with the definitions of likelihood in the IPCC 5th Assessment Report (Ref. 9.24), described in **Table 9.9.**

Table 9.9: Level of likelihood of the climate hazard occurring

Level of likelihood	Definition of likelihood
Very likely	90-100% probability that the hazard will occur
Likely	66-100% probability that the hazard will occur

Level of likelihood	Definition of likelihood
Possible, about as likely as not	33-66% probability that the hazard will occur
Unlikely	0-33% probability that the hazard will occur
Very unlikely	0-10% probability that the hazard will occur

**Note: The likelihood levels have been taken from the IPCC fifth assessment report. There is a certain amount of overlap in the criteria provided to allow for uncertainty and the qualitative approach of the assessment.*

Likelihood of climate impact occurring

9.5.16 The likelihood of a climate impact occurring has been assigned based on likelihood of the hazard occurring combined with the vulnerability of the Proposed Development, using professional judgement and in discussion with the design team. Embedded mitigation measures have also been taken into account and a likelihood rating has been assigned as described in **Table 9.10**.

Table 9.10: Likelihood of the climate impact occurring for CCR assessment

Level of likelihood	Definition of likelihood
Very likely	90-100% probability that the impact will occur during the life of the project
Likely	66-100% probability that the impact will occur during the life of the project
Possible, about as likely as not	33-66% probability that the impact will occur during the life of the project
Unlikely	0-33% probability that the impact will occur during the life of the project
Very unlikely	0-10% probability that the impact will occur during the life of the project

Consequence of climate impact

9.5.17 Criteria for assessing consequence for CCR are defined in **Table 9.11** and are based on the criteria used in the LLAOL Climate Change Adaptation Report (Ref. 9.25) for the measure of severity/ benefit. The report outlines how LLAOL are addressing the impacts of climate change on their organisation, a requirement of infrastructure operators and public bodies under the Adaptation Reporting Power as summarised in **Table 9.1.**

Table 9.11: Consequence criteria for CCR assessment

Consequence	Consequence criteria
Catastrophic Adverse	Total service loss for significant period (>1 day); adverse international publicity; Loss/litigation potential of £10m
Major Adverse	Sustained service disruption (>2 hrs); public enquiry; litigation potential of £1m - £10m

Consequence	Consequence criteria
Considerable Adverse	Service disruption for 1-2 hrs; national adverse publicity; litigation potential of £500k-£1m
Moderate Adverse	Minor impact on London Luton Airport services; local adverse publicity; litigation
Minor Adverse	Annoyance but does not disrupt London Luton Airport services; isolated customer complaints; litigation potential of <£50k
Insignificant Adverse	Cost negligible; low financial loss
No change	No foreseen impact or benefit
Slight Beneficial	Negligible reduction in expenditure or litigation potential; negligible improvement in service delivery
Minor Beneficial	Small reduction in expenditure or litigation potential of <50k; positive customer feedback; small improvements in service delivery potential
Moderate Beneficial	Temporary reduction in expenditure or litigation potential of 50k-£500k; beneficial local publicity; temporary improvements in service delivery
Considerable Beneficial	Considerable reduction in expenditure/ or litigation potential of £500k-£1m; beneficial national publicity; considerable improvements in service delivery
Major Beneficial	Long-term large-scale reduction in expenditure and litigation potential of >£1m-£10m; sustainable beneficial national publicity; sustained improvements in service delivery
Substantial Beneficial	Large and permanent reduction in expenditure/ litigation potential of >£10m; permanent improvement in corporate reputation; beneficial international publicity; large and permanent improvements in service delivery

9.5.18 The CCR assessment has assumed that the Proposed Development will be designed to be resilient to impacts arising from current weather events and climatic conditions, and designed in accordance with current planning, design and engineering practice and codes.

9.5.19 The assessment has also identified and taken into account the resilience mitigation measures incorporated in the Proposed Development design. These are listed in **Section 9.8**.

9.5.20 In line with the ANPS, consideration has been given to 'more radical' changes to the climate beyond those projected in the latest set of UKCP18 to demonstrate that there are no critical features of infrastructure design which may be seriously affected.

9.5.21 Plausible higher and lower end climate change projections have been obtained from both the H++/L-- scenarios, and the UKCP18 Probabilistic Projections of Climate Extremes (PPCE) (Ref. 9.26).

9.5.22 The H++ and L-- scenarios assess very low probability, high impact risks and use UKCP09 as one of the sources for information. H++ projections have not been updated for UKCP18 data at the time of writing, therefore the UK Committee on Climate Change Adaptation Sub-Committee Report Developing H++ Climate Change Scenarios (Ref. 9.27) has been used here.

9.5.23 The PPCE (Ref. 9.28) provide information on 21st Century temperature and precipitation extremes across the UK. They have been analysed for the 25 km grid square where the Proposed Development is located. These daily figures have been expressed as absolute values in relation to the 1981-2000 baseline, for the Winter season (Dec, Jan, Feb), RCP8.5 scenario, and 1 in 100 return period. The highest percentile value available has been selected to represent the worst-case scenario.

Significance criteria

9.5.24 While there are no specific significance criteria for the assessment of CCR, a framework has been developed by combining the outcomes from the likelihood of impact with the consequence to determine the level of effect, as shown in **Table 9.12**. Where a risk is determined as High or Very high this has been deemed significant. This is based on the approach from the LLAOL Climate Change Adaptation Report (Ref. 9.29) as referenced in **paragraph 9.5.17**.

Table 9.12: Level of effect criteria for climate change resilience impacts

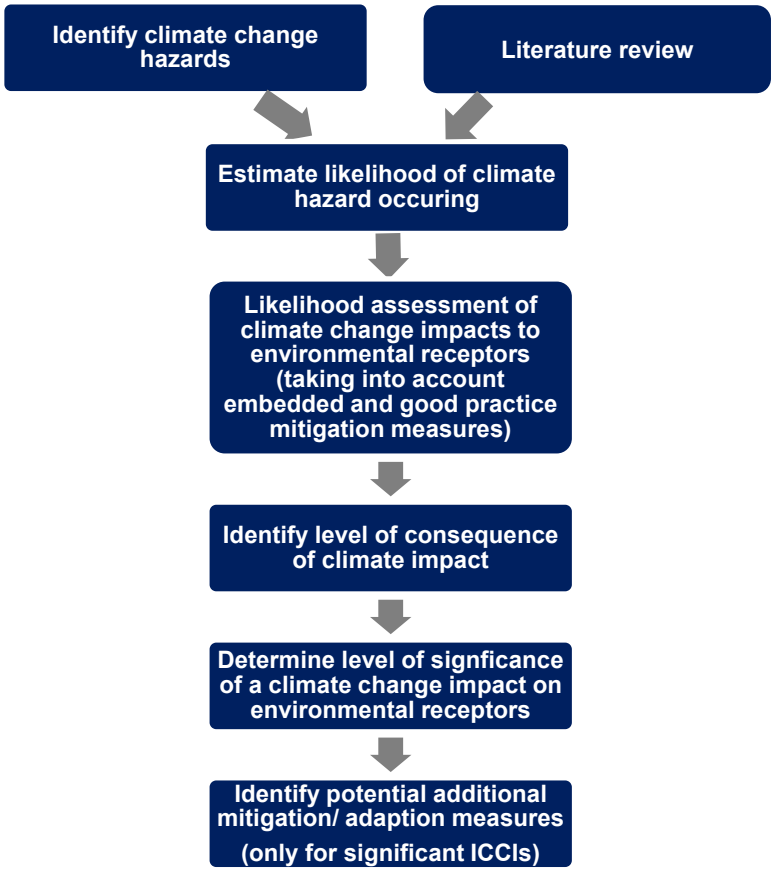
		Likelihood of a climate impact occurring				
		Very unlikely	Unlikely	Possible, about as likely as not	Likely	Very likely
Consequence	Catastrophic Adverse/ Substantial Beneficial	L	M	VH	VH	VH
	Major	L	M	H	H	VH
	Considerable	L	M	H	H	H
	Moderate	L	M	M	M	H
	Minor	L	L	L	M	M
	Insignificant	L	L	L	L	L
	No change	L	L	L	L	L

**Note: VH = Very high effect, H = High effect, M = Moderate effect, L = Low effect*

In-combination climate change impacts

9.5.25 The ICCI assessment as outlined in **Inset 9.2** qualitatively assessing how the effects identified by other environmental disciplines are affected by future climate change within the design life of the Proposed Development.

Inset 9.2: ICCI assessment methodology flow diagram



9.5.26 The sections below outline the method shown in the diagram in more detail and provide details on assessment criteria. Climate change specialists worked with the other environmental disciplines throughout this process.

Identifying climate change hazards

9.5.27 The process used to identify hazards for the CCR assessment has been followed to identify hazards for the ICCI assessment.

Likelihood of climate hazard occurring

9.5.28 The likelihood of a climate hazard occurring has been based on the approach outlined above for the CCR assessment. A likelihood rating has been assigned as described in **Table 9.9**.

Likelihood of a climate change impact occurring

9.5.29 In defining likelihood of an impact occurring, embedded and good practice mitigation measures have been accounted for. Definitions of likelihood are set out in **Table 9.13**.

9.5.30 The likelihood of an impact occurring has been based on the likelihood of the climate hazard occurring combined with the sensitivity of the receptors as defined in relevant environmental disciplines, using professional judgement.

Table 9.13: Level of Likelihood of the climate change impact occurring

Level of likelihood	Definition of likelihood
Likely	66-100% probability that the impact will occur during the life of the project
Possible, about as likely as not	33-66% probability that the impact will occur during the life of the project
Unlikely	0-33% probability that the impact will occur during the life of the project

** Note: The likelihood levels are based on those in the IPCC fifth assessment report.*

9.5.31 **Table 9.14** has been then used to determine the overall likelihood of the ICCI. As per above, embedded and good practice mitigation measures have been accounted for.

Consequence

9.5.32 Criteria for assessing the consequence of in-combination impacts are defined in **Table 9.14** and have been based on the change to the significance of the effect of the Proposed Development on the resource or receptor for each relevant environmental discipline.

Table 9.14: Consequence criteria for ICCI assessment

Consequence	Consequence criteria
High	The climate change parameter in-combination with the effect of the Proposed Development causes the significance of the impact of the Proposed Development on the resource/receptor, as defined by the topic, to increase from moderate to major.
Medium	The climate change parameter in-combination with the effect of the Proposed Development causes the significance of the impact of the Proposed Development on the resource/receptor, as defined by the topic, to increase from low to moderate.
Low	The climate change parameter in-combination with the effect of the Proposed Development causes the significance of the impact of the Proposed Development on the resource/receptor, as defined by the topic, to increase from negligible to low.
Very low	The climate change parameter in-combination with the effect of the Proposed Development does not impact the significance of the impact of the Proposed Development on the resource/receptor, as defined by the topic.

Significance criteria

9.5.33 The significance of effects has been determined using the matrix in **Table 9.15.** Where an impact has been identified as moderate and major, this has been deemed significant. This is different to the CCR significance threshold to align with the other discipline assessments.

Table 9.15: ICCI scale of impact criteria to establish significance

		Likelihood		
		Unlikely	**Possible**	**Likely**
Consequence	**Very Low**	Negligible	Negligible	Minor
	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

9.5.34 A summary of the potential ICCIs identified by each discipline is summarised in the respective discipline chapters. The complete findings of the ICCI assessment have been presented in **Section 9.9** and **Table 9.28** of this chapter.

9.6 Assumptions and limitations

9.6.1 This section provides a description of the assumptions and limitations to the CCR and ICCI assessments.

9.6.2 The probabilistic projections from UK Climate Projections (UKCP18) are presented to include the 60-year project design life (the temporal scope for the assessment), i.e. from the start of construction through to end of design life. These time periods include: 2020-2049, 2040-2069, 2070-2099.

9.6.3 Data for the regional 12km projections, which provide information on local climate effects within a defined 12km square location is only available up to 2079. This data has been used to generate the projections in **Table 9.19** and **Table 9.20**; meaning that these extremes cannot be explored beyond 2079 up to the end of the project design life.

9.6.4 All climate change projections are subject to uncertainties, due to the complexity of the climate system, natural climate variability, uncertainty over future greenhouse gas emission levels and modelling uncertainties. For example, there is uncertainty in climate models and regarding how global climatic trends will be reflected at the regional scale. Leading climate change data from the UKCP18 programme has been used to explore trends and magnitude of change at the regional scale. UKCP18 is the result of over seven years work by the Met Office's Hadley Centre Climate Programme and over thirty years of work from other contributing organisations. UKCP18 builds upon UKCP09 to provide the most up-to-date assessment of how the climate of the UK may change over the 21st century. Additionally, to account for this

uncertainty we have considered climate projections at the 10%, 50% and 90% probability levels.

9.6.5 Information on climate change effects on lightning and fog is not currently available in UKCP18. Modelled data for lightning is to be introduced to UKCP18 later in 2021 (Ref. 9.30) and will be reviewed for the ES. At present it is unknown if data for fog will become available. UKCP18 will continue to be monitored for the ES, in case data becomes available.

9.6.6 Assessments made in relation to 'consequence' and 'likelihood' have relied on professional judgement and evidence gathered through other environmental topic assessments, such as biodiversity, air quality, noise, and the Proposed Development design team.

9.6.7 All existing assets are assumed to be maintained in line with LLAOL's existing Climate Change Adaptation Report (Ref. 9.31) or any subsequent equivalent document that may supersede it and therefore are not assessed here. This report assesses future impacts for new assets only.

Reasonable Worst Case

9.6.8 **Chapter 5** Approach to the Assessment in Volume 2 of this PEIR describes the general approach adopted to ensure that a reasonable worst case is assumed in this assessment including the use of parameters, accounting for uncertainty, and incorporating flexibility in design and demand forecasts.

9.6.9 Further relevant assumptions on worst case specific to this assessment include:

a. This assessment represents a worst-case scenario of how climate change could impact the Proposed Development as the climate projections used in the assessment are for the highest emissions scenario available representing a global temperature increase of approximately 4.3˚C by 2100, relative to pre-industrial temperatures (RCP 8.5).

b. As mentioned above, in line with the ANPS (Ref. 9.32), consideration has been given to 'more radical' changes to the climate beyond those projected in the latest set of UKCP18 in line with the ANPS (Ref. 9.33) to demonstrate that there are no critical features of infrastructure design which may be seriously affected by climate change. Consideration has been given to plausible higher and lower end climate change projections from both the H++/L-- scenarios, and the recently released PPCE (Ref. 9.34).

9.7 Baseline conditions

9.7.1 This section provides a description of the existing conditions in the Study Area as described in **Section 9.3**.

Existing conditions

9.7.2 Historic climate data obtained from the Met Office website recorded by the meteorological station closest to the Proposed Development (Rothamsted No.2) for the period 1981-2010[2] indicates the following:

a. Average annual maximum daily temperature was 13.7 °C.
b. Warmest month on average was July (mean maximum daily temperature of 21.8°C).
c. Coldest month on average was February (mean minimum daily temperature of 1 °C).
d. Average total annual rainfall levels were 712.3 mm.
e. Wettest month on average was October (81.1 mm of rainfall on average for the month).
f. Driest month on average was February (47.7 mm of rainfall on average for the month).

9.7.3 Baseline data for the climate extremes obtained from the observational gridded dataset released as part of UKCP18 are recorded in **Table 9.19.**

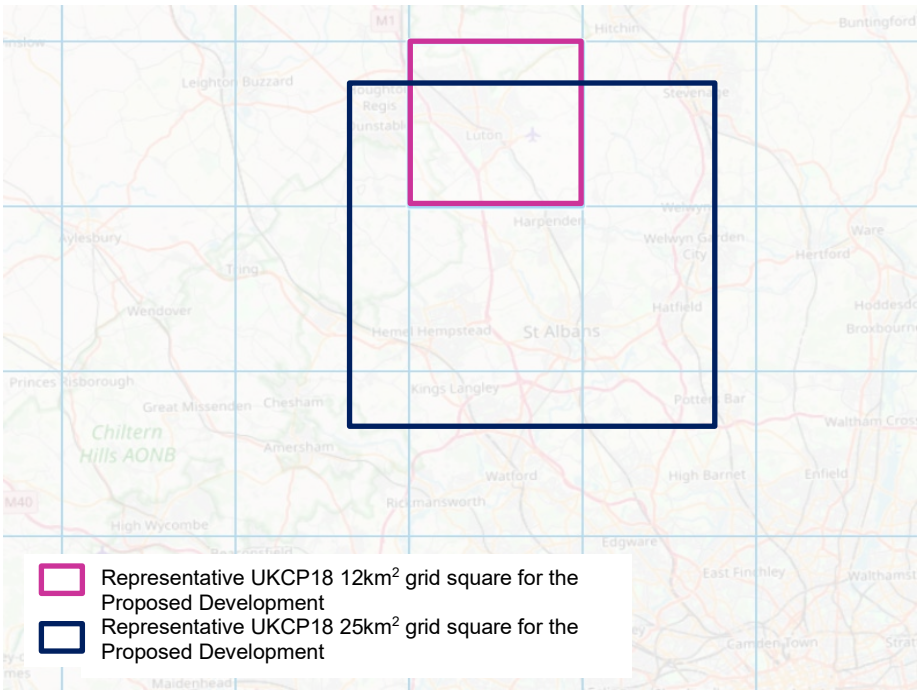
Future baseline

9.7.4 Regardless of whether or not the Proposed Development goes ahead, there is likely to be a change to the future baseline conditions as a result of climate change.

9.7.5 Projected changes in temperature, precipitation, and specific humidity are presented in **Table 9.16** and **Table 9.17** and **Table 9.18** respectively. These tables include the UKCP18 probabilistic projections (Ref. 9.35) for the 25km grid square where the Proposed Development is located as shown in **Inset 9.3** These figures are expressed as anomalies in relation to the 1981-2010 baseline.

[2] Historic climate station data from the Met Office is currently only available up to 2010 and is not available for the last 10 years.

Inset 9.3: UKCP18 representative 12km^2 and 25km^2 grid squares relevant to the Proposed Development



9.7.6 The climate projections have been presented to include the 60-year design life of the Proposed Development (the temporal scope for the assessment), at the 10%, 50% and 90% probability levels for RCP8.5. The 50% probability levels are shown in bold in **Table 9.16** and **Table 9.17** and **Table 9.18** and the 10% and 90% probability levels are shown in brackets.

Table 9.16: Projected changes to temperature parameters (°C)

Climate parameter	Time period		
	2020-2049	2040-2069[3]	2070-2099
Mean annual air temperature anomaly at 1.5m (°C)	**+1.1** (+0.4 to +1.8)	**+2.0** (+0.9 to +3.0)	**+3.7** (+2.0 to +5.7)
Mean Summer air temperature anomaly at 1.5m (°C)	**+1.4** (+0.5 to +2.3)	**+2.5** (+1.0 to +4.1)	**+4.9** (+2.0 to +7.8)
Mean Winter air temperature anomaly at 1.5m (°C)	**+0.9** (+0.1 to +2.0)	**+1.7** (+0.5 to +3.0)	**+3.1** (+1.0 to +5.1)
Maximum Summer air temperature anomaly at 1.5m (°C)	**+1.5** (+0.5 to +2.7)	**+2.9** (+0.9 to +5.0)	**+5.7** (+2.3 to 9.3)

[3] Data available from UKCP18 is for pre-determined 30-year periods. To allow projections to be presented up to the end of the century there is an overlap of 10 years for the first and second time periods presented.

Climate parameter	Time period		
	2020-2049	2040-2069[3]	2070-2099
Minimum Winter air temperature anomaly at 1.5m (°C)	**+0.9** (-0.2 to +2.0)	**+1.7** (+0.4 to +3.1)	**+3.1** (+1.0 to +5.5)

** Note: 1.5m from sea level*

Table 9.17: Projected changes to precipitation parameters (%)

Climate parameter	Time period		
	2020-2049	2040-2069	2070-2099
Annual precipitation rate anomaly (%)	**+0.6** (-3.5 to +4.9)	**-1.9** (-8.0 to +4.2)	**-1.2** (-6.9 to +4.4)
Summer precipitation rate anomaly (%)	**-10.2** (-29.8 to +8.5)	**-21.3** (-46.2 to +3.1)	**-36.0** (-65.6 to -2.8)
Winter precipitation rate anomaly (%)	**+6.5** (-4.1 to +17.5)	**+10.2** (-4.7 to +26.4)	**+20.4** (0.0 to +43.9)

Table 9.18: Projected changes in humidity parameters (%)

Climate parameter	Time period		
	2020-2049	2040-2069	2070-2099
Annual specific humidity anomaly at 1.5m (%)	**+5.4** (+0.1 to +11.1)	**+10.0** (+3.0 to +17.9)	**+20.2** (+8.8 to +32.7)
Summer specific humidity anomaly at 1.5m (%)	**+5.4** (-1.9 to +12.7)	**+9.8** (-0.6 to +20.5)	**+18.1** (+2.0 to +34.7)
Winter specific humidity anomaly at 1.5m (%)	**+5.7** (-1.7 to +13)	**+10.9** (+1.0 to +21.7)	**+22.2** (+6.7 to +39.3)

9.7.7 Further data has been obtained for other climate variables and extreme weather events. These have been assessed using land projections at a 12km resolution from UKCP18 (as shown in **Inset 9.3**) and are presented in **Table 9.19** and **Table 9.20**.

9.7.8 The baseline values in **Table 9.19** are from UKCP18 climate models or "projected baseline" (mean of 12 models for period 1981-2010).

9.7.9 In **Table 9.19** and **Table 9.20**:

a. Min = minimum of the 12 climate models (RCP 8.5);

b. Mean = mean value of the 12 climate models (RCP 8.5); and

c. Max = maximum value of the 12 climate models (RCP 8.5).

9.7.10 **Table 9.19** presents the absolute climate projections for each time period. **Table 9.20** presents the anomalies (i.e. the change in the climate parameter relative to the baseline period).

Table 9.19: Projected changes extremes (absolute)

Climate parameter	Baseline (1981-2010)		2020-2049			2040-2069			2050-2079		
	Observed	Projected	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Annual number of frost days (daily minimum temperature equal or lower than 0°C)	49.2	37.6	24.9	33.0	46.0	19.7	24.7	35.0	16.8	20.9	27.7
Annual number of heatwaves (2 days with maximum temperature higher than 29°C and minimum temperature higher than 15°C)	0.3	0.5	0.3	2.1	5.3	1.8	5.7	11.9	3.9	9.0	16.1
Number of hot days (daily maximum temperature higher than 25°C)	14.5	11.0	21.6	35.5	59.7	35.0	55.5	79.4	41.2	67.8	90.5
Summer highest daily maximum temperature (ºC)	28.5	26.4	29.4	31.7	34.3	31.3	33.7	36.3	32.6	34.8	37.4
Annual number of dry spells (10 or more consecutive days without precipitation (defined as 0.2mm)	4.3	1.3	4.0	34.7	5.6	4.4	5.3	6.1	4.5	5.6	6.7
Annual number of days per year when precipitation is greater than 25mm per day (Met Office definition of 'heavy rain') (Ref. 9.36)	1.2	1.3	0.8	1.5	2.4	0.9	1.5	2.2	1.1	1.6	2.3

Table 9.20: Projected changes extremes (anomalies)

Climate parameter	2020-2049			2040-2069			2050-2079		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Annual number of frost days (daily minimum temperature equal or lower than 0°C)	-24.3	-16.2	-3.2	-29.5	-24.5	-14.2	-32.4	-28.3	-21.5
Annual number of heatwaves (2 days with maximum temperature higher than 29°C and minimum temperature higher than 15°C)	0.0	1.8	5.0	1.5	5.4	11.6	3.6	8.7	15.8
Number of hot days (daily maximum temperature higher than 25°C)	7.1	21.0	45.2	20.5	41.0	64.9	26.7	53.3	76.0
Summer highest daily maximum temperature (ºC)	0.9	3.2	5.8	2.8	5.2	7.8	4.1	6.3	8.9
Annual number of dry spells (10 or more consecutive days without precipitation (defined as 0.2mm)	-0.3	0.4	1.3	0.1	1.0	1.8	0.2	1.3	2.4
Annual number of days per year when precipitation is greater than 25mm per day (Met Office definition of 'heavy rain') (Ref. 9.37)	-0.4	0.3	1.2	-0.3	0.3	1.0	-0.1	0.4	1.1

9.7.11 Compared to the current baseline, UKCP18 projections (mean and RCP 8.5) highlight that by the end of the century:

a. mean summer temperatures are expected to increase by 4.9°C;
b. mean winter temperatures are expected to increase by 3.1°C;
c. summer precipitation is expected to decrease by 36%; and
d. winter precipitation is expected to increase by 20%.

9.7.12 Compared to the current baseline, UKCP18 projections (mean and RCP 8.5) highlight that by 2079 as shown in **Table 9.20**:

a. the annual number of heatwaves is expected to increase by 8.7;
b. the annual number of frost days is expected to decrease by 28.3;
c. the number of dry spells (10 or more consecutive days without precipitation (defined as 0.2mm) is expected to increase by 1.3; and
d. the number of days with heavy rain (precipitation higher than 25mm/day is expected to increase by 0.4.

9.7.13 **Table 9.21** presents the plausible high-end projections of the climate change projections (i.e. a worst case scenario for climate extremes). Information is presented from both the H++/L-- scenarios, and the recently released UKCP18 PPCE (Ref. 9.38). Note that baseline reference periods vary for the different climate events based on the data availability for extremes.

Table 9.21: Plausible high-end climate change scenarios (absolute)

Climate event	H++ / L-- scenarios	UKCP18 PPCE
High temperature	Hottest Summer days could exceed 48°C (H++)	Maximum air temperature at 1.5m: 27°C
Low temperature	Minimum Winter temperature (L--)[4]: 2020s: -7°C 2080s: -11°C	N/A
High precipitation	The H++ scenario for high precipitation projects a 70-100% increase in Winter rainfall (December to February), from a 1961-1990 baseline. Increased frequency (up to 5x) and daily/sub-daily depth of high precipitation events in both Summer and Winter (H++)	1-day total precipitation: 64mm 5-day total precipitation: 107mm
Low precipitation	Significant increases in 6-month summer droughts (a precipitation deficit up to 60% less than the long-term average 1900-1999), with no notable change in Winter	N/A

[4] This L - - scenario is considered extremely unlikely, and there is low confidence in the evidence that supports this future trend. However, extreme cold weather events have been considered as part of the climate change assessments to ensure that potential future climate impacts are adequately assessed.

Climate event	H++ / L-- scenarios	UKCP18 PPCE
	droughts. However, longer and drier periods (a precipitation deficit of up to 20% less than the long-term 1900-1999 average) lasting 3 to 5 years are possible (H++)	
Wind	Increased number of days per year with strong winds to increase between 50 – 80% greater than a 1975-2005 baseline (strong winds defined here as UK-averaged daily mean wind speeds over the 99th percentile of historical simulations, at 850 hectopascals (hPa)) (H++)	N/A

9.8 Embedded and good practice mitigation measures

9.8.1 This section describes the embedded and good practice mitigation for Climate Change Resilience that has been incorporated into the Proposed Development design or will be secured as a requirement of the DCO. A definition of these classifications of mitigation and how they are considered in the EIA is provided in **Chapter 5** Approach to the Assessment in Volume 2 of this PEIR.

Embedded

Climate change resilience

Construction

9.8.2 All construction mitigation measures outlined below are included in the Draft Code of Construction Practice (CoCP) (**Appendix 4.2** of Volume 3 of the PEIR). The adoption and implementation of the CoCP by appointed contractors will be a requirement of the DCO.

9.8.3 The contractors will conduct a high-level risk assessment of severe weather impacts on the construction process to inform any required mitigation. Any receptors and/or construction-related operations and activities potentially sensitive to severe weather events will be considered in the assessment. Climate change projections will also be considered in the risk assessments.

9.8.4 The contractors will use a short to medium range weather forecasting service from the Met Office, or other approved meteorological data and weather forecast provider, to inform short to medium term programme management, environmental control and impact mitigation measures.

9.8.5 The contractors will register with the Environment Agency's flood warning service in areas of flood risk.

9.8.6 The main contractors' Environmental Management System (EMS) will consider all measures deemed necessary and appropriate to manage severe weather events and should, as a minimum, cover training of personnel and prevention

and monitoring arrangements. As appropriate, construction method statements will also consider severe weather events where risks have been identified.

9.8.7 The contractors will as far as reasonably practicable use construction materials with superior properties that offer increased tolerance to fluctuating temperatures, heavy precipitation and other extreme weather events such as storms.

9.8.8 Construction works will be carried out in accordance with the Soils Management Plan (SMP) (**Appendix 6.6** of Volume 3 of the PEIR).

9.8.9 The proposed phasing assumes that the vulnerable aspects of earthworks will not be done during the Winter months.

9.8.10 Construction works will be carried out in accordance with airport requirements of working airside e.g. airside construction works will be paused if there is low visibility or increased dust being blown across airfield.

Operation

9.8.11 CCR has been taken into account in the sift/optioneering stages of the Proposed Development that influenced the 'future airport layout' and has also influenced the design to date.

9.8.12 The Drainage Design Statement (**Appendix 20.4** of Volume 3 of the PEIR) of the Proposed Development can accommodate for surface water flows during 1 in 100 years storm event, accounting for an increase in precipitation of 40% due to climate change aligned with Environment Agency guidance (Ref. 9.39).

9.8.13 Water efficiencies are built into the Proposed Development through the Drainage Design Statement (**Appendix 20.4** of Volume 3 of the PEIR). Rainwater harvesting from the roofs will allow greywater storage and re-use where practicable and appropriate. This enables an increase in the level of efficiency in water use per passenger, thus increases resilience to drought events.

9.8.14 Thermal efficiency will be incorporated into building design, taking climate change into account to reduce summer cooling and winter heating.

9.8.15 Landscape planting will take into consideration climate change in the selection of appropriate species for planting and habitat creation and provide adequate monitoring post-planting. No specific design standards have been used for landscaping, but the proposals seek to deliver multi-functional green infrastructure and have been developed with consideration to the Landscape Institute's Position Statement on Climate Change (Ref. 9.40). This will be secured through the Landscape and Biodiversity Management Plan (**Appendix 8.2** of Volume 3 of the PEIR).

9.8.16 Pavement design will be designed to accommodate future climate change conditions e.g. temperature increases.

9.8.17 Assets will be maintained regularly to detect deterioration and damage caused by extreme weather events such as storms through maintenance and monitoring in contracts.

In-combination Climate Change Impacts

9.8.18 **Table 9.22** and **Table 9.23** summarise the embedded and good practice mitigation measures identified by the other disciplines and how these influence the ICCI assessment.

Construction

Table 9.22: ICCI embedded and good practice mitigation measures - construction

Receptor	Changes and effects	Embedded and good practice mitigation measure
Air quality (**Chapter 7**) and soils and geology receptors (**Chapter 17**)	Increased dusts and airborne contamination to soils during construction due to extended dry spells.	Minimised as far as reasonably practicable, through the measures incorporated into the Draft CoCP (e.g. reduce dust emissions through the effective transportation and storage of materials such as dampening down of dusts particularly where material is stockpiled), and the proposed monitoring regime.
Agricultural land quality and farm holdings (**Chapter 6**)	Increase winter precipitation in increases risk of structural damage to soil resources if handled when too wet.	Implement SMP, as part of the Draft CoCP.

Table 9.23: ICCI embedded and good practice mitigation measures - operation

Receptor	Changes and effects	Embedded and good practice mitigation measure
Biodiversity (**Chapter 8**)	Degradation of ecosystem services and reduced food availability as a result of increased annual temperatures.	The proposed habitat creation/enhancement will include various plant food sources as well as habitats suitable for invertebrates to support species present on site and will be selected based on resilience to future temperature changes. This will be secured through the Landscape and Biodiversity Management Plan (**Appendix 8.2** in Volume 3 of the PEIR).
	Impacts to retained sensitive habitats and reduced success of new planting as a result of decrease in annual precipitate.	The Drainage Design Statement (**Appendix 20.4** of Volume 3 of the PEIR) will ensure that there is no significant change to water availability within retained habitats and areas of new open

Receptor	Changes and effects	Embedded and good practice mitigation measure
		space, planting and habitat creation and has accounted for future climate changes, including reduced water availability.
Health and community (**Chapter 13**)	Climate change exacerbates the effect the Proposed Development has on health and community, particularly in relation to increased summer temperatures and flooding.	New trees and planting in replacement open space to provide areas of shade and cooling. This will be secured through the Landscape and Biodiversity Management Plan (**Appendix 8.2** in Volume 3 of the PEIR).
Landscape and visual (**Chapter 14**)	The increased occurrence of heatwaves and droughts and their potential to reduce the growth rates of plant material and/ or increase the likelihood of plant failure.	Climate change will be considered in the selection of landscaping species and the detail specification for the soil growing medium, and through monitoring put in place. This will be secured through the Landscape and Biodiversity Management Plan (**Appendix 8.2** in Volume 3 of the PEIR).
Water resources and flood risk (**Chapter 20**)	Water shortages due to increasing summer air temperatures and decreasing summer precipitation.	A Water Cycle Strategy will be prepared to inform the ES to assess how potential water use associated with the Proposed Development will affect water resources and infrastructure considering potential impacts of climate change. The Drainage Design Statement (**Appendix 20.4** of Volume 3 of the PEIR) includes a description of measures to minimise water use and maximum water reuse. The use of such measures will be considered in the Water Cycle Strategy prepared to inform the ES.
	Less snow and ice, potentially resulting in increased surface water runoff in winter periods	The design has been developed to accommodate the volume and rate of water generated by a 1 in 100-year return period storm event, including a 40% uplift to

Receptor	Changes and effects	Embedded and good practice mitigation measure
	Flooding may have an impact on leachate generation.	allow for potential increases in rainfall due to climate change as set out in the Drainage Design Statement (**Appendix 20.4** of Volume 3 of the PEIR). A capping layer including drainage management systems will be in place across the whole of the landfill and hence infiltration will not interact with the waste to generate leachate once constructed.

Good Practice

9.8.19 Using appropriate design guidance where available, all buildings, surface access routes, taxiways, aprons and other airside and airfield assets will be designed for the climatic conditions projected for the end of their design life.

9.8.20 Concepts within CEN-CENELEC Guide 32: Guide for addressing climate change adaptation in standards (Ref. 9.41) will be embedded within the design of all assets.

9.8.21 All surface access transport infrastructure will be designed to Environment Agency guidance on flood risk assessments: climate change allowances (Ref. 9.42) and the principles set out in the Luton Local Transport Plan (Ref. 9.43).

9.8.22 Requirements for consideration of climate change impacts on groundwater levels, soil moisture content and precipitation are included in the construction and design of earthworks and structures in-line with BS EN1997-1 (Ref. 9.44) and BS6031 Code of Practice for Earthworks (Ref. 9.45).

9.9 Preliminary assessment

9.9.1 This section presents the results of the preliminary assessment of likely significant effects with the embedded and good practice mitigation measures, described in the previous section, in place.

9.9.2 A summary of the assessment of effects is provided on **Table 9.26** in **Section 9.14**. The likelihood of significant effects is discussed in further detail in this section.

Climate change resilience

Construction

9.9.3 The effects of climate change may result in a range of short-term climate risks during the construction of the Proposed Development through the potential

increase in the occurrence and/or magnitude of extreme weather events, including:

a. extreme weather events such as heatwaves, heavy precipitation and increased snowfall/freezing disrupting construction timescales;
b. health risk to construction workers from heatwaves and other extreme weather;
c. water availability causing disruption and delays during construction;
d. flooding may cause disruption to soil structures and increase rate of runoff; and
e. weather conditions can negatively impact the use of construction materials e.g. water evaporation can occur in hot weather, changing the water to cement ratio and decreasing compressive strength.

9.9.4 The assessment as provided in **Table 9.26** and **Table 9.27** shows that no significant effects have been identified given the incorporation of embedded and best practice mitigation measures.

Operation

9.9.5 A summary of the potential climate change impacts identified in the CCR assessment includes:

a. damage to assets and infrastructure due to flooding;
b. damage to assets as a result of extreme weather such as storms and high wind speeds creating or distributing debris disrupting train services and airfield operations;
c. reduced reliability of the Luton DART as a result of track damage or train failure caused by extreme weather events;
d. increased heat stress for passengers, staff, and outdoor maintenance workers;
e. lightning striking the airport resulting in an aircraft accident or loss of telecommunications;
f. increasing Summer temperatures would require airlines to burn more fuel to get the aircraft off runway;
g. because water levels can be variable in chalky soils, periods of high rainfall in Winter could cause groundwater levels to rise to higher than predicted;
h. potential issue with groundwater levels as variable in chalk and respond quickly to rainwater;
i. increased Summer temperature and increased Winter temperature variability has the potential to cause damage to the asphalt and affect operations;
j. prolonged periods of dry spells leading to drought and reducing the potable water availability required for the operation of both terminals;

k. increase in fire risk during hot days, and increased risk in damage to fuel operations due to lightning strikes;

l. flood water management infrastructure can be stressed by exacerbation of flood events under future climates; and

m. potential to damage the open space and habitats if planting is not resilient to climate change.

9.9.6 The assessment as provided in **Table 9.26** and **Table 9.27** shows that no significant effects have been identified given the incorporation of embedded and best practice mitigation measures.

In-combination Climate Change Impacts

9.9.7 **Table 9.28** summarises the findings from the preliminary ICCI assessment and shows that no significant effects have been identified at this stage of design given the incorporation of embedded and best practice mitigation measures.

Sensitivity Analysis

9.9.8 There are certain known scenarios or risks that may occur that could influence the conclusions of the core assessment. These scenarios and the general approach to considering them in this assessment are described in **Section 5.4** of **Chapter 5:** Approach to the Assessment.

9.9.9 **Table 9.24** provides a qualitative assessment of any likely changes to the conclusions of the assessment reported in this chapter, in the event that that scenario or risk is realised.

Table 9.24: Qualitative Sensitivity Analysis

Sensitivity scenario	Potential impact and change	Likely effect
19 mppa application granted	Not likely to impact the resilience of the Proposed Development to climate change or change assessment outcome.	No change to effect and to remain not significant
Faster growth scenario	Not likely to impact the resilience of the Proposed Development to climate change or change assessment outcome.	No change to effect and to remain not significant
Slower growth scenario	Not likely to impact the resilience of the Proposed Development to climate change or change assessment outcome.	No change to effect and to remain not significant

9.10 Additional mitigation

9.10.1 This section describes the mitigation measures identified as a result of the assessment process, that are proposed in addition to those already considered to be in place as described in **Section 9.8** Embedded and good practice

mitigation measures. These are proposed to reduce or mitigate the effects of climate change on the Proposed Development and ICCI effects.

Construction

9.10.2 For both the CCR and ICCI assessments, no mitigation measures in addition to those identified in **Section 9.8** are proposed, as no likely significant effects during construction have been identified.

Operation

9.10.3 For both the CCR and ICCI assessments, no mitigation measures in addition to those identified in **Section 9.8** are proposed, as no likely significant effects during construction have been identified.

9.11 Residual effects

Construction effects

9.11.1 No additional mitigation has been proposed/is practicable with respect to construction CCR effects. As such the effects would be as reported in **Section 9.9**.

9.11.2 No additional mitigation has been proposed/is practicable with respect to construction ICCI effects. As such the effects would be as reported in **Section 9.9.**

Operational effects

9.11.3 No additional mitigation has been proposed with respect to operational CCR effects. As such the effects would be as reported in **Section 9.9.**

9.11.4 No additional mitigation has been proposed with respect to operational ICCI effects. As such the effects would be as reported in **Section 9.9.**

9.12 Monitoring

Construction monitoring

Climate change resilience

9.12.1 As outlined in the Draft CoCP (**Appendix 4.2** of Volume 3 of the PEIR), the lead contractors' EMS will consider all measures deemed necessary and appropriate to manage severe weather events and should, as a minimum, cover training of personnel and prevention and monitoring arrangements. Operational monitoring arrangements.

Operational monitoring

Climate change resilience

9.12.2 All assets will be maintained regularly to detect deterioration and damage caused by extreme weather events such as storms through maintenance and monitoring in contracts.

9.12.3 Landscape planting will take into consideration climate change in the selection of appropriate species for planting and habitat creation and provide adequate monitoring post-planting.

9.12.4 A list of extreme weather-related incidents (for example, road surface deformations from extreme heat, storms, snow and ice etc.) will be maintained to assist in identifying thresholds which, when exceeded, require maintenance.

9.13 Preliminary assessment summary

9.13.1 **Table 9.26** and **Table 9.27** provide a summary of the identified impacts, mitigation and likely effects of climate change on the Proposed Development.

9.13.2 **Table 9.28** provides a summary of the identified ICCI impacts, mitigation and likely effects on the Proposed Development.

Table 9.25: CCR preliminary assessment summary: construction phase (2020-2049)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring	Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring	Consequence	Description of effect and significance (including embedded and good practice mitigation)
Materials and equipment required for the construction of all built assets, structures, staff facilities	Extreme weather events (such as storms)	Likely	Damage to staff facilities, structures, materials, construction equipment resulting in delays to construction programme and associated costs and/or unacceptable safety risks, as well as high winds increasing dust (and other construction debris).	A high-level risk assessment of severe weather impacts on the construction process will be produced by the main contractor to inform mitigations. Any receptors and/or construction-related operations and activities potentially sensitive to severe weather events should be considered in the assessment. Climate change projections should be considered in the risk assessments. The main contractors' EMS should consider all measures deemed necessary and appropriate to manage severe weather events and should as a minimum cover training of personnel and prevention and monitoring arrangements. As appropriate, construction method statements should also consider severe weather events where risks have been identified.	Unlikely	Moderate Adverse	Moderate (Not significant)
Access routes to construction sites	Increased frequency and intensity of heavy precipitation	Likely	Viability of and access to construction sites (such as heavy rain resulting in surface water flooding of local roads, sources of power supply or inundation of construction sites).	The contractors will use a short to medium range weather forecasting service from the Met Office, or other approved meteorological data and weather forecast provider, to inform short to medium term programme management, environmental control and impact mitigation measures. The contractors will register with the EA's flood warning service in areas of flood risk. The main contractors' EMS should consider all measures deemed necessary and appropriate to manage severe weather events and should as a minimum cover training of personnel and prevention and monitoring arrangements. As appropriate,	Possible	Moderate Adverse	Moderate (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring	Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring	Consequence	Description of effect and significance (including embedded and good practice mitigation)
				construction method statements should also consider severe weather events where risks have been identified.			
Workers on construction sites	Increased average Summer temperatures, increased humidity and increasing frequency of hot days and heatwaves	Likely	Increased heat stress/heat exhaustion for workers.	The Draft CoCP states that lead contractors will consider climate change impacts to construction workers and should develop health and safety plans to prevent worker exhaustion due to heat, manage flood risk during construction and provide safety measures to mitigate against high winds. In addition, the Draft Climate Change Resilience (CCR) Plan sets out the requirement to design temporary buildings with measures to control summertime overheating.	Unlikely	Moderate Adverse	Moderate (Not significant)
	More extreme cold weather events	Unlikely	Possible negative health implications for workers on construction site.	The Draft CoCP states that lead contractors will consider climate change impacts to construction workers and should develop health and safety plans to prevent worker exhaustion due to heat, manage flood risk during construction and provide safety measures to mitigate against high winds.	Unlikely	Moderate Adverse	Moderate (Not significant)

Table 9.26: CCR preliminary assessment summary: operation phase

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
Luton DART extension to the new terminal	Increased frequency and intensity of heavy precipitation	Likely	Very likely	Damage to track due to flooding and water ingress to critical equipment, including traction power distribution sites, leading to signalling or other electronic equipment failures, requiring switch off or, possibly causing damage.	All surface transport infrastructure will be designed to Environment Agency guidance on Flood risk assessments: climate change allowances (Ref. 9.46) and the principles of the Luton Local Transport Plan (Ref. 9.47). The Drainage Design Statement of the Proposed Development can accommodate for surface water flows during 1 in 100 years storm event, accounting for an increase in precipitation of 40% due to climate change. All assets will either be designed for the climatic conditions projected for the end of their design life, using appropriate design guidance where available or adaptive capacity will be built into the designs.	Unlikely	Unlikely	Moderate Adverse	Moderate (Not significant)	Moderate (Not significant)
	Increased average and Summer high	Likely	Very likely	Rail buckling and/or associated	All assets will either be designed for the climatic conditions	Unlikely	Unlikely	Minor Adverse	Low (Not significant)	Low (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
	temperatures and increasing frequency of hot days and heatwaves			misalignment problems. Increased heat stress for passengers and staff on trains, as well as outdoor maintenance workers.	projected for the end of their design life, using appropriate design guidance where available or adaptive capacity will be built into the designs. Adequate heating, ventilation and air-conditioning (HVAC) systems provided on trains.					
	More extreme cold weather events	Unlikely	Possible	Possible negative health implications for passengers and staff.		Unlikely	Unlikely	Moderate Adverse	Moderate (Not significant)	Moderate (Not significant)
	More extreme cold weather events	Unlikely	Possible	Reliability of trains may reduce at low temperatures due to: failure of train horns due to ice/snow accretion; failure of sliding doors, couplers, pneumatic devices and reduced effectiveness of brakes due to ice/snow accretion; traction motor failures due to snow and/or water ingress, and damage from snow and/or ice accretions dislodged at speed.		Possible	Possible	Moderate Adverse	Moderate (Not significant)	Moderate (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
	Extreme weather events (including storms)	Likely	Likely	Damage to assets and high wind speeds may create or distribute debris to track disrupting services.		Possible	Possible	Moderate Adverse	Moderate (Not significant)	Moderate (Not significant)
Additional taxiways and aircraft stands	Extreme weather events (including storms) and increased frequency and intensity of heavy precipitation	Likely	Very likely	Potential to result in hazardous conditions for operation of vehicles and aircraft, slowing the system and causing delays. Increased intensity of wind events also has the potential to cause disruption to taxiway utilisation and schedules, resulting in flight delays. Risk of water damage affecting taxiways, underground foundations, structures or services.	All assets will either be designed for the climatic conditions projected for the end of their design life, using appropriate design guidance where available or adaptive capacity will be built into the designs. The Drainage Design Statement of the Proposed Development can accommodate for surface water flows during 1 in 100 years storm event, accounting for an increase in precipitation of 40% due to climate change.	Unlikely	Unlikely	Major Adverse	Moderate (Not significant)	Moderate (Not significant)
	Increased temperatures and increasing frequency of hot days and heatwaves	Likely	Very likely	Increased Summer temperature has the potential damage to the tarmac and asphalt and effect operations.	Use of construction materials with superior properties which offer increased tolerance to high temperatures.	Unlikely	Unlikely	Considerable Adverse	Moderate (Not significant)	Moderate (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
	More extreme cold weather events	Unlikely	Possible	Increased risk of surfaces freezing	New de-icing facilities are incorporated into the Proposed Development.	Unlikely	Unlikely	Considerable Adverse	Moderate (Not significant)	Moderate (Not significant)
Aircraft operations	Increased Summer temperatures, increased humidity and increasing frequency of hot days and heatwaves	Likely	Very likely	Increased Summer temperature can increase the frequency of lightning strikes. Lightning striking the airport could result in an aircraft accident or loss of telecommunications.	On-site rescue and firefighting service are the first-responders for any incident within the airport boundary.	Unlikely	Unlikely	Catastrophic Adverse	Moderate (Not significant)	Moderate (Not significant)
	Increased temperatures and increasing frequency of hot days and heatwaves	Likely	Very likely	Air pressure changes affecting maximum take-off weight capacity, can result in increase in occurrence of days outside the acceptable range of temperatures affecting aircraft and their utilisation schedule.	Measures relating to allowances in maximum take-off weight and maximum plane operating temperature are managed by standard flight operation procedures.	Unlikely	Unlikely	Moderate Adverse	Moderate (Not significant)	Moderate (Not significant)
	Increased temperatures and increasing frequency of hot days and heatwaves	Likely	Very likely	Delays in re-fuelling procedures as result of flashpoint of aviation fuel exceeded on hot days.	On-site rescue and firefighting service are the first-responders for any incident within the airport boundary.	Unlikely	Unlikely	Minor Adverse	Low (Not significant)	Low (Not significant)
	Extreme weather events	Possible	Possible	Aircrafts not permitted to land	New de-icing facilities are incorporated into	Unlikely	Unlikely	Considerable Adverse	Moderate (Not significant)	Moderate (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
	(including storms)			or take off, causing delays	the Proposed Development.					
New terminal, and associated buildings, including airside facilities, and other supporting buildings such as, police station, hotels. logistics centre and technical, including end users such as staff and passengers.	Extreme weather events (including storms, high winds)	Likely	Very likely	Potential damage to the building and structure fabric.	All new buildings and assets will either be designed for the climatic conditions projected for the end of their design life, using appropriate design guidance where available or adaptive capacity will be built into the designs. Concepts within CEN-CENELEC GUIDE 32: (Ref. 9.41) Guide for addressing climate change adaptation in standards will be embedded within the further design of all assets.	Unlikely	Unlikely	Considerable Adverse	Moderate (Not significant)	Moderate (Not significant)
	Increased frequency and intensity of heavy precipitation	Likely	Very likely	Extreme precipitation events could lead to flooding of assets and infrastructure.	The Drainage Design Statement of the Proposed Development can accommodate for surface water flows during 1 in 100 years storm event, accounting for an increase in precipitation of 40% due to climate change.	Unlikely	Unlikely	Considerable Adverse	Moderate (Not significant)	Moderate (Not significant)
	Increased frequency of dry spells	Likely	Very likely	Prolonged periods of dry spells could lead to drought and may reduce the potable water	Water efficiencies are built into the Proposed Development through the Drainage Design Statement. Rainwater	Unlikely	Unlikely	Major Adverse	Moderate (Not significant)	Moderate (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
				availability required for building operations.	harvesting from the roofs will allow greywater storage and re-use where practicable and appropriate.					
	Increased average and Summer temperatures and increasing frequency of hot days and heatwaves	Likely	Very likely	Overheating from increased summer temperature due to inadequate HVAC systems is also a risk.	Adequate HVAC systems provided. At this stage of the design, passive strategies for heating, cooling and lighting are being explored.	Unlikely	Unlikely	Minor Adverse	Moderate (Not significant)	Moderate (Not significant)
	More extreme cold weather events	Possible	Possible	Reliability of journeys may reduce at low temperatures due to cracking of pavement surfaces and snow/ice accretion on aircraft and runways/airfield pavements causing delays.	New de-icing facilities are incorporated into the Proposed Development.	Unlikely	Unlikely	Moderate Adverse	Moderate (Not significant)	Moderate (Not significant)
Cargo terminal	Extreme weather events (including storms, high winds)	Likely	Very likely	Potential damage to the building and structure fabric.	All assets will either be designed for the climatic conditions projected for the end of their design life, using appropriate design guidance where available or adaptive capacity will be built into the designs.	Unlikely	Unlikely	Considerable Adverse	Moderate (Not significant)	Moderate (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
					Concepts within CEN-CENELEC GUIDE 32 (Ref. 9.41) Guide for addressing climate change adaptation in standards will be embedded within the further design of all assets.					
	Increased frequency and intensity of heavy precipitation	Likely	Very likely	Extreme precipitation events could lead to flooding of the logistics centre and technical service buildings and the ancillary infrastructure.	The Drainage Design Statement of the Proposed Development can accommodate for surface water flows during 1 in 100 years storm event, accounting for an increase in precipitation of 40% due to climate change.	Unlikely	Unlikely	Considerable Adverse	Moderate (Not significant)	Moderate (Not significant)
Highway network improvements, car parking facilities, bus, coach and taxi facilities and airside roads	Increased frequency and intensity of heavy precipitation	Likely	Very likely	Damage to roads and car parks because of flooding and cause disruption to users.	All surface access assets will either be designed for the climatic conditions projected for the end of their design life, using appropriate design guidance where available or adaptive capacity will be built into the designs. Concepts within CEN-CENELEC GUIDE 32: (Ref. 9.41) Guide for addressing climate change adaptation in standards will be	Unlikely	Unlikely	Moderate Adverse	Moderate (Not significant)	Moderate (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
					embedded within the further design of all assets.					
	Extreme weather events (including storms)	Likely	Very likely	Damage to assets and high wind speeds may create or distribute debris to these areas and cause disruption to users.		Unlikely	Unlikely	Moderate Adverse	Moderate (Not significant)	Moderate (Not significant)
	Increased Summer temperatures and increasing frequency of hot days and heatwaves	Likely	Very likely	Increased risk of thermal expansion and movement of paved surfaces, and material deterioration and cause disruption to users.	Use of construction materials with superior properties which offer increased tolerance to high temperature.	Unlikely	Unlikely	Moderate Adverse	Low (Not significant)	Low (Not significant)
Drainage and pollution control assets (sewage and effluent treatment plants)	Increased frequency and intensity of heavy precipitation	Likely	Very likely	Extreme precipitation events could lead to flooding and could exacerbate acute and chronic impacts on foul, non-potable and surface water infrastructure.	An allowance for climate change has been incorporated into the design of pollution capture assets; 1 in 100 years storm event, accounting for an increase in precipitation of 40% due to climate change.	Unlikely	Unlikely	Considerable Adverse	Low (Not significant)	Low (Not significant)
Fuel farm	Increased frequency and intensity of heavy precipitation	Likely	Very likely	Can exacerbate acute and chronic impacts on fuel and transfer assets due to an increase of flood risk.	All assets will be designed for the climatic conditions experienced at the end of their operational life cycle, using appropriate design guidance. The Drainage Design Statement of the	Unlikely	Unlikely	Considerable Adverse	Moderate (Not significant)	Moderate (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
					Proposed Development can accommodate for surface water flows during 1 in 100 years storm event, accounting for an increase in precipitation of 40% due to climate change.					
	Increasing Summer temperatures, increased humidity and increasing frequency of hot days and heatwaves	Likely	Very likely	Increase in fire risk during hot days, and increased risk in damage to fuel operations due to lightning strikes.	On-site rescue and firefighting service are the first-responders for any incident within the airport boundary.	Unlikely	Unlikely	Major Adverse	Moderate (Not significant)	Moderate (Not significant)
Flood alleviation and storage infrastructure i.e. water infiltration (soakaway) and attenuation tanks, fire, water and energy storage assets.	Increased frequency and intensity of heavy precipitation	Likely	Very likely	Flood water management infrastructure can be stressed by exacerbation of flood events under future climates.	Consideration of climate change in all drainage infrastructure and flood retention infrastructure. The Drainage Design Statement of the Proposed Development can accommodate for surface water flows during 1 in 100 years storm event, accounting for an increase in precipitation of 40% due to climate change.	Unlikely	Unlikely	Considerable Adverse	Moderate (Not significant)	Moderate (Not significant)
On and off-site electrical facilities and utilities corridors.	Extreme weather events (including storms), increased	Likely	Very likely	Potential to damage the over and underground electricity network either through direct contact (for		Very unlikely	Very unlikely	Major Adverse	Low (Not significant)	Low (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
	frequency and intensity of heavy precipitation, increased Summer temperatures and number of hot days			example, flooding or wind damage), or through damage to structures or buildings supporting this network (for example, heat buckling of HV cables, subsidence). Multiple events over a short timescale are likely to have the greatest impact as these will inhibit any maintenance activities.						
	Increasing average and Summer temperatures	Likely	Very likely	Sensitive electronic equipment and mechanical operating mechanisms may fail to operate correctly due to high temperatures.		Unlikely	Unlikely	Moderate adverse	Moderate (Not significant)	Moderate (Not significant)
De-icing storage facility	Extreme weather events (including storms)	Likely	Very likely	Extreme weather, such as storms and high winds have the potential to cause damage to the building and structure fabric.	All assets will either be designed for the climatic conditions projected for the end of their design life, using appropriate design guidance where available or adaptive capacity will be built	Unlikely	Unlikely	Considerable Adverse	Moderate (Not significant)	Moderate (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
					into the designs. Concepts within CEN-CENELEC GUIDE 32: (Ref. 9.41) Guide for addressing climate change adaptation in standards will be embedded within the further design of all assets.					
	Increased frequency and intensity of heavy precipitation	Likely	Very likely	Extreme precipitation events could lead to flooding of the storage facility.	The Drainage Design Statement of the Proposed Development can accommodate for surface water flows during 1 in 100 years storm event, accounting for an increase in precipitation of 40% due to climate change.	Unlikely	Unlikely	Considerable Adverse	Moderate (Not significant)	Moderate (Not significant)
Public open space and amenities	Extreme weather events (including storms)	Likely	Very likely	Potential to damage the open space and habitats if planting is not resilient to climate change.	Landscape planting will take into consideration climate change in the selection of appropriate species for planting and habitat creation and provide adequate monitoring post-planting.	Possible	Possible	Minor Adverse	Low (Not significant)	Low (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
	Increased frequency and intensity of heavy precipitation	Likely	Very likely	Potential to damage the open space and habitats if planting is not resilient to climate change.	Sustainable drainage systems (SuDS) and permeable surfacing suitable for extreme rainfall events.	Possible	Possible	Minor Adverse	Low (Not significant)	Low (Not significant)
	Increased frequency of dry spells	Likely	Very likely	Potential to damage the open space and habitats if planting is not resilient to climate change.	Landscape planting will select species that are resistant to warm and dry weather e.g. drought tolerant species. Water efficiencies are built into the Proposed Development through the Drainage Design Statement. Rainwater harvesting from the roofs will allow greywater storage and re-use where practicable and appropriate. SuDS and permeable surfacing suitable for drought events	Unlikely	Unlikely	Minor Adverse	Low (Not significant)	Low (Not significant)
	Increasing average and Summer temperatures and increasing	Likely	Very likely	Potential to damage the open space and habitats if planting is not resilient to climate change.	Shading (of public spaces and buildings) suitable for extreme hot events in the future.	Unlikely	Unlikely	Minor Adverse	Low (Not significant)	Low (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
	frequency of hot days and heatwaves				Landscape planting will select species that are resistant to warm and dry weather e.g. drought tolerant species. Maintenance of connectivity for enabling migration of species under increased temperatures					
Energy centre	Extreme weather events (including storms)	Likely	Very likely	Damage and disruption to power supply to airport.	All assets will either be designed for the climatic conditions projected for the end of their design life, using appropriate design guidance where available or adaptive capacity will be built into the designs. Concepts within CEN-CENELEC GUIDE 32: (Ref. 9.41) Guide for addressing climate change adaptation in standards will be embedded within the design of all assets.	Unlikely	Unlikely	Major Adverse	Moderate (Not significant)	Moderate (Not significant)
Fire training facility	Extreme weather events (including storms)	Likely	Very likely	Extreme weather, such as storms and high winds have the potential to cause damage to the building and structure fabric.	All assets will either be designed for the climatic conditions projected for the end of their design life, using appropriate design guidance where	Unlikely	Unlikely	Moderate Adverse	Moderate (Not significant)	Moderate (Not significant)

Proposed Development asset(s) (receptor)	Climate change hazard	Likelihood of climate change hazard occurring		Climate change impact	Embedded/good practice mitigation measures	Likelihood of climate change impact occurring		Consequence	Description of effect and significance (including embedded and good practice mitigation)	
		2040 - 2069	2070 - 2099			2040 - 2069	2070 - 2099		2040 - 2069	2070 - 2099
					available or adaptive capacity will be built into the designs.					
	Increased frequency and intensity of heavy precipitation	Likely	Very likely	Extreme precipitation events could lead to flooding of the facility and damage to training equipment.	The Drainage Design Statement of the Proposed Development can accommodate for surface water flows during 1 in 100 years storm event, accounting for an increase in precipitation of 40% due to climate change.	Unlikely	Unlikely	Moderate Adverse	Moderate (Not significant)	Moderate (Not significant)

Table 9.27: ICCI preliminary assessment summary

Discipline	Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
Air quality **(Chapter 7)**	Increased number of hot days; increase of droughts.	Possible	Increased dust production during construction due to extended dry spells.	During the construction phase, extended dry spells may cause increased dust production. This consequence would be minimised as far as reasonably practicable, through the measures incorporated into the Draft CoCP (e.g. reduce dust emissions through the effective transportation and storage of materials), including the proposed monitoring regime.	Unlikely	Very low	Negligible Not significant
	Increased number of hot days.	Very likely	Hotter and drier / drought conditions could change concentrations of certain air pollutants such as NO_x, $PM_{2.5}$ PM_{10} and ozone (O_3).	It is unlikely that hotter and drier/drought conditions will exacerbate concentrations of NOx, $PM_{2.5}$ and PM_{10} because aircraft engines and ground transportation, such as cars, are expected to be cleaner in the future. This is because aircraft engines will comply with emission standards set by the Committee on Aviation Environmental Protection (CAEP) and there will be improvements in road vehicle technology and changes in fleet composition with higher	Possible	Very low	Negligible Not significant

Discipline	Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
				proportion of low emission vehicles, as predicted by Defra. O_3 is likely to increase and consequently affect NO_2 concentrations. O_3 is a trans-boundary pollutant which is formed in the atmosphere from reactions involving other pollutants. It is not directly emitted from processes that can be regulated, therefore there are limited mitigation measures available to the Applicant in relation to O_3. The change in surface O_3 concentrations are likely to be small in comparison to the important precursor pollutants to O_3 formation (NOx, methane, and non-methane volatile organic compounds).			
	Increased number of hot days.	Very likely	Hotter conditions could increase aircraft emissions due to the steeper climb angles taken.	It is unlikely that conditions will exacerbate emissions because aircraft engines are expected to be cleaner in the future.	Possible	Very low	Negligible Not significant
	Changes to wind speed	Possible	Changes in wind speed and direction	There is considerable uncertainty in projections for changes in wind speed	Unlikely	Very low	Negligible Not significant

Discipline	Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
			could influence local pollutant levels.	and wind direction, and studies show statistically insignificant variation in wind speed. Monitoring measures are already in place. If there is increased channelling due to changes in wind direction this would increase annual average levels at some receptors and decrease them at others. However, Defra predicts that background concentrations are likely to decrease.			
Noise and vibration (**Chapter 16**)	Increase in occurrence of heatwaves	Very likely	Potential to exacerbate noise effects on communities in terms of individual dwellings and on a wider community, due to windows being open more often due to an increase in high temperatures.	The noise assessment criteria assume windows are open when internal noise levels are considered. Consequently, there is no further impact on noise effects arising from the ICCI.	Possible	Very Low	Negligible Not significant
	Increase in mean	Very likely	Increases in temperature and humidity	Over distances of a few hundred metres, atmospheric effects can be	Possible	Very Low	Negligible Not significant

Discipline	Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
	temperature and humidity		of the air reducing the atmospheric attenuation of noise.	ignored for sound with low frequency prominence, such as aircraft noise. Consequently, increases in temperature and humidity is unlikely to affect ground-based noise sources such as ground noise, construction noise and surface access noise. Due to the longer distances that aircraft noise travels, the effect of increases in temperature and humidity can affect aircraft noise levels. However, the change in atmospheric absorption will only have a significant effect on high frequencies. Given the prominence of low frequencies in aircraft noise, it is expected that changes in noise will not result in additional impacts.			
Soils and geology **(Chapter 17)**	Decreased Summer precipitation; increased summer temperatures	Very likely	Dry exposed Made Ground and landfill waste could lead to increased production of dusts and airborne	The consequence of this ICCI is minimised as far as reasonably practicable using good construction practice measures set out in the Draft CoCP for example, dampening down of dusts particularly where material is stockpiled.	Possible	Low	Minor Not significant

Discipline	Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
			contamination soils.				
		Very likely	Differential settlement of ground caused by decreases in moisture content can be sufficient to damage property, roads, and infrastructure.	The design of the Proposed Development takes into account ground conditions, and how this may be affected by future climate change. Mitigation such as surcharging/ground improvement techniques, flexible pavements and modified service connections.	Possible	Low	Minor Not significant
	Increase in maximum/mean Summer air temperature	Very likely	Increase in soil temperature due to hotter conditions. Increased soil temperatures may increase rate emission of volatile contaminants and gases in soils.	Gas management measures detailed in **Section 17.8** will prevent gas migration into the buildings on site. If necessary, perimeter gas protection measures will prevent gas migration off-site.	Possible	Very low	Negligible Not significant
		Very likely	Decrease in heavy metal mobility due to hotter conditions. Heavy metals are less likely to be leached in drier	Hardstanding/engineered landscaping and the proposed capping means there is unlikely to be any direct contact with underlying soils.	Possible	Very low	Negligible Not significant

Discipline	Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
			condition, leading to increased persistence in soils.				
	Increase in winter precipitation rate	Very Likely	Changing precipitation patterns, increased flood risk could lead to increased soil erosion.	Mitigation measures used during construction to prevent erosion such as compaction of soils, phased excavation, use of temporary capping and geotextile layers. During operational period the design includes hardstanding and an engineered cover system for hardstanding and soft landscapes which makes soil erosion unlikely.	Possible	Very Low	Negligible Not significant
Water resources and flood risk (**Chapter 20**)	Increase in mean annual air temperature Increase in mean Summer air temperature	Very likely	Increase in air temperature potentially affecting groundwater recharge and availability for abstraction	Though increased air temperatures have the potential to effect groundwater recharge and availability, overall impacts are likely to be minor compared with the annual seasonal variations and the increased variability anticipated in rainfall. A Water Cycle Strategy will also be prepared to inform the ES to assess how potential water use associated with the Proposed Development will	Possible	Low	Minor Not significant

Discipline	Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
				affect water resources and infrastructure considering potential impacts of climate change. The Drainage Design Statement includes a description of measures to minimise water use and maximum water reuse. The use of such measures will be considered in the Water Cycle Strategy prepared to inform the ES.			
	Increase in mean Winter air temperature Increase in minimum air temperature	Very likely	Less snow and ice, potentially resulting in increased surface water runoff in winter periods	The design has been developed to accommodate the volume and rate of water generated by a 1 in 100-year return period storm event, including a 40% uplift to allow for potential increases in rainfall due to climate change.	Possible	Very low	Negligible Not significant
	Decrease in annual precipitation rate Decrease in Summer precipitation rate	Very likely	Changing precipitation patterns and water shortage (Potentially drought)	A Water Cycle Strategy will be prepared to inform the ES to assess how potential water use associated with the Proposed Development will affect water resources and infrastructure considering potential impacts of climate change. The Drainage Design Statement includes a	Possible	Low	Minor Not significant

Discipline	Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
				description of measures to minimise water use and maximum water reuse. The use of such measures will be considered in the Water Cycle Strategy prepared to inform the ES.			
	Increase in annual specific humidity Increase in Summer specific humidity Increase in Winter specific humidity	Very likely	Increase in heavier precipitation events and risk of flooding and impact on leachate generation	The design has been developed to accommodate the volume and rate of water generated by a 1 in 100-year return period storm event, including a 40% uplift to allow for potential increases in rainfall due to climate change. A decrease in annual precipitation would lead to a reduction in leachate generation. However, the increased intensity of rainfall events may cause the generation of large quantities of leachate. A capping layer including drainage management systems will be in place across the extent of the historic landfill affected by the Proposed Development to ensure that infiltration will not interact with the waste to reduce the	Possible	Very low	Negligible Not significant

Discipline	Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
				potential for leachate generation.			
Health and community (**Chapter 13**)	Increased occurrence of high Summer temperatures, humidity and heatwaves	Very likely	Potential increase in heat risk for vulnerable members of population due to partial loss of Wigmore Valley Park, and the consequent decrease in shade provision and cooling effect from the existing mature trees and vegetation.	The replacement open space will provide a greater area of open green space, but it will take time for the new trees and planting to mature and provide comparable levels of shade and cooling.	Unlikely	Low	Negligible Not significant
Agricultural and land use (**Chapter 6**)	Increase in Winter precipitation rate	Very likely	Soil resources of high sensitivity (low resilience) are at risk of structural damage if handled when too wet, particularly during the late autumn and winter.	Implement Soil Management Plan (SMP), as part of the Draft CoCP to mitigate this.	Possible	Low	Minor Not significant

Discipline	Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
Biodiversity (**Chapter 8**)	Increase in mean annual air temperature	Very likely	Degradation of ecosystem services and reduced food availability.	The proposed habitat creation/enhancement will include various plant food sources as well as habitats suitable for invertebrates to support those species present on site and will be selected based on resilience to future temperature changes. This will avoid any significant changes to the food chain and the interactions that shape the flow of energy/distribution of biomass within the ecosystem.	Possible	Very low	Negligible Not significant
	Decrease in annual precipitation rate	Very likely	Further impacts to retained sensitive habitats and reduced success of new planting	The Drainage Design Statement will ensure that there is no significant change to water availability within retained habitats and has accounted for future climate changes, including reduced water availability. . Resilience of landscaping to climate change will be ensured by the habitat creation/enhancement requirements provided within the PEIR to ensure that climate change is taken into consideration in the choice of species and adequate monitoring post-	Possible	Very low	Negligible Not significant

Discipline	Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
				planting occurs in accordance with the LBMP.			
	Increased number and frequency of hot days; increase of droughts	Very likely	Reduced success of establishment of new planting due to hotter drier conditions	Resilience of landscaping to climate change will be ensured by the habitat creation/enhancement requirements provided within the ES to ensure that climate change is taken into consideration in the choice of species and adequate monitoring post-planting occurs in accordance with the LBMP	Possible	Very low	Negligible Not significant
	Increased frequency and intensity of heavy precipitation	Very likely	Reduced success of establishment of new planting due to wetter conditi ons	Resilience of landscaping to climate change will be ensured by the habitat creation/enhancement requirements provided within the ES to ensure that climate change is taken into consideration in the choice of species and adequate monitoring post-planting occurs in accordance with the LBMP.	Possible	Very low	Negligible Not significant
Landscape and visual (**Chapter 14**)	Increase in Summer air temperature s and heatwaves Decrease in Summer	Very likely	The increased occurrence of heatwaves and droughts and their potential to reduce the growth rates	Climate change will be considered in the selection of landscaping species and the detail specification for the soil growing medium, and through monitoring put in place.	Possible	Low	Minor Not significant

Discipline	Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
	precipitation rate		of plant material and/ or increase the likelihood of plant failure.				
Greenhouse gases (**Chapter 12**)	Increased Summer air temperatures	Very likely	Increased energy required for cooling in buildings. Increased ambient temperatures with lowers air density and requires higher fuel consumption to increase thrust.	Possible increases of GHG emissions will be mitigated through measures within through the Draft GHG Management Plan (**Appendix 12.1** of Volume 3 of the PEIR)	Possible	Very low	Negligible Not significant
	Extreme weather events (including high winds)	Very likely	Stronger winds and changing wind patterns might lead to modifications of flight lengths and routings, resulting in increase in the fuel consumption.	Possible increases of GHG emissions will be mitigated through measures within the Draft GHG Management Plan (**Appendix 12.1** of Volume 3 of the PEIR)	Possible	Very low	Negligible Not significant

9.14 Completing the assessment

9.14.1 The following activities will be undertaken to complete the assessment, the results of which will be presented in the ES:

a. Discussions will continue with the design teams as the design of the Proposed Development progresses. The preliminary CCR assessment will be updated as appropriate and the findings presented in the ES.

b. The ICCI assessment will be updated as appropriate for the ES based on the final assessments from other relevant topics.

c. Further engagement with stakeholders will be undertaken as set out in **Section 9.4** and presented in the ES.

COMPETENT EXPERTS

Topic	Role	Company	Qualifications/competencies/experience of author
Climate Change	Author	Aecom	MSc International Marketing Management with Sustainability, BSc Economics, GradIEMA, 8 years of experience working in the sustainability sector
Climate Change	Author	Aecom	MSc Carbon Management, MA(Hons) Geography, PIEMA, 5 years' experience working in the field of climate change and sustainability
Climate Change	Contributor	Arup	BSc Geography (Hons) Chartered Environmentalist (CEnv) MInEnvSc PIEMA 7 years' experience in environmental and climate change sector
Climate change	Technical reviewer	Arup	MSc Environmental Engineering, MSc Industrial engineering, PhD climate change uncertainties, CWEM, more than 10 years of experience in the field of climate change resilience
Climate Change	Technical reviewer	Arup	MEng Civil Engineering, Eng. Doctorate in Environmental Technologies, MIEMA, Chartered Environmentalist (CEnv) more than 20 years of professional experience in the field of climate change

GLOSSARY AND ABBREVIATIONS

Term	Definition
ANPS	Airports National Policy Statement
ACRP	Airport Cooperatives Research Programme
CAA	Civil Aviation Authority
CBC	Central Bedfordshire Council
CCC	Committee on Climate Change
CCR	Climate Change Resilience
CCRA	Climate Change Risk Assessment
DCO	Development Consent Order
EIA	Environmental Impact Assessment
ES	Environmental Statement
ICAO	International Civil Aviation Organisation
ICCI	In-combination Climate Change Impacts
IEMA	Institute of Environmental Management and Assessment
LBC	Luton Borough Council
LLAOL	London Luton Airport Operations Limited
LBMP	Landscape and Biodiversity Management Plan
NHDC	North Hertfordshire District Council
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NPS	National Policy Statement
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PPCE	Probabilistic Projections of Climate Extremes
RCP	Representative Concentration Pathway
UKCP18	UK Climate Projections 2018

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