Gatwick Airport Northern Runway Project

Environmental Statement
Chapter 15: Climate Change

Book 5

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15 Climate Change

15.1. Introduction

15.1.1 This chapter of the Environmental Statement (ES) presents the findings of the Environmental Impact Assessment (EIA) concerning the potential effects of current and future climate change on the proposal to make best use of Gatwick's existing runways and infrastructure (referred to within this report as 'the Project'). The assessment for greenhouse gases (GHG) (the potential effects on, and the contribution of the Project to, the climate) is reported in **ES Chapter 16: Greenhouse Gases** (Doc Ref. 5.1).

15.1.2 This Chapter 15: Climate Change of the ES presents the assessment of the following:

- **Climate Change Resilience (CCR):** the resilience of the design, construction and operation of the Project to projected future climate change impacts. Decommissioning has been scoped out of this assessment.
- **In-combination Climate Change Impacts (ICCI):** the combined effects of the Project and its potential climate change impacts on the receiving environment and community.

15.1.3 In particular, this ES chapter:

- sets out the existing and future environmental baseline conditions, established from desk studies and consultation to date;
- presents the potential environmental effects of climate change on the Project, based on the information gathered and the analysis and assessments to date;
- identifies any assumptions and limitations encountered in compiling the environmental information;
- highlights any necessary mitigation measures that could prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process; and
- describes any monitoring required during construction or operation.

15.1.4 This chapter is supported by the following figures and appendices:

- ES Figure 15.5.1: UKCP18 Climate Projection Data Grid Cell for the Project site boundary at 12km x 12km Resolution
- ES Figure 15.5.2: UKCP18 Climate Projection Data Grid Cell for the Project site boundary at 25km x 25km Resolution
- ES Appendix 15.2.1: Summary of Local Planning Policy – Climate Change;
- ES Appendix 15.3.1 Summary of Stakeholder Scoping Responses – Climate Change;
- ES Appendix 15.3.2 Summary of Stakeholder PEIR Responses – Climate Change;
- ES Appendix 15.4.1: Climate Change Resilience Definitions;
- ES Appendix 15.5.1: Sensitivity Analysis – Climate Extremes;
- ES Appendix 15.5.2: Urban Heat Island Assessment;
- ES Appendix 15.8.1: Climate Change Resilience Assessment; and
- ES Appendix 15.9.1: In-Combination Climate Impact Assessment.

15.1.5 The Preliminary Environmental Information Report (PEIR) chapter identified Next Steps, and these have been addressed in this chapter as follows:

- Discussions with the design teams continued to enhance the understanding of the risk profile for the receptors where high risks were identified in the preliminary CCR assessment.
- A sensitivity analysis has been undertaken (see Section 15.5 and **ES Appendix 15.5.1: Sensitivity Analysis – Climate Extremes** (Doc Ref. 5.3)) to consider more extreme climate changes, and the impacts that these may have on the resilience of the Project.
- The preliminary CCR assessment from the PEIR has been updated based on the **ES Chapter 5: Project Description** (Doc Ref. 5.1).
- The ICCI assessment has been updated based on the final assessment from other relevant EIA topics.
- The designs of the flood risk and drainage systems for use during the construction period have been confirmed and reflected in the CCR Assessment (Section 0 and **ES Appendix 15.8.1: Climate Change Resilience Assessment** (Doc Ref. 5.3)).

15.2. Legislation and Policy

Legislation

15.2.1 The Infrastructure Planning (EIA) Regulations 2017 requires a description of the factors likely to be significantly affected by the development including climate (for example GHG emissions and impacts relevant to adaptation) (Schedule 4 (Para 4(4))) and a description of the likely significant effects of the development on the environment resulting from "*the impact of the project on climate (for example the nature and magnitude of GHG emissions) and the vulnerability of the project to climate change"* (Schedule 4 (para 5(f)).

15.2.2 The Climate Change Act 2008 (Section 56) (amended 2019) commits the Secretary of State (SoS; Department for Business, Energy and Industrial Strategy (BEIS)) to *"lay reports before Parliament containing an assessment of the risks for the United Kingdom of the current and predicted impact of climate change"'*.

15.2.3 This includes a mechanism under which certain organisations report on their preparedness in relation to climate change. The SoS directed a number of infrastructure owners and operators, including London Gatwick Airport (referred to hereafter as Gatwick), to input to the first round of reporting. The second and third rounds of reporting were voluntary. The UK Climate Change Act 2008 required Gatwick to report on how the airport is addressing current and future climate impacts. Gatwick has developed Climate Change Adaptation Reports (CCAR) for all three rounds of reporting. The third round reports were published in 2021. These existing adaptation reporting processes are relevant to this assessment as all climate change risk assessment (CCRA) and associated environmental measures identified through this assessment would feed into Gatwick's reporting in future rounds (through construction and operation).

15.2.4 The CCAR must be prepared at no longer than five yearly intervals. To date three CCARs have been produced (Gatwick Airport Ltd, 2011, 2016 and 2021a). Paragraph 4.49 of the Airports National Policy Statement (ANPS) (Department for Transport, 2018a) requires that adaptation measures proposed in relation to new airport infrastructure are based on the most recent CCAR (Department for Environment, Food and Rural Affairs (Defra), 2017).

15.2.5 Section 58 (1) of the Climate Change Act 2008 notes: *'It is the duty of the Secretary of State to lay programmes before Parliament setting out — (a) the objectives of Her Majesty's Government in the United Kingdom in relation to adaptation to climate change, (b) the Government's proposals and policies for meeting those objectives, and (c) the time-scales for introducing those proposals*

and policies, addressing the risks identified in the most recent report under section 56.' The National Adaption Programme (NAP) is prepared by the SoS in response to this obligation.

15.2.6 The NAP must contribute to sustainable development and should be presented as soon as possible after the CCRA reporting under Section 56 has been completed (s58(2) and (3)).

Planning Policy Context

National Policy Statements

15.2.7 The ANPS (Department for Transport, 2018a), although primarily provided in relation to a new runway at Heathrow Airport, remains a relevant consideration for other applications for airport infrastructure in London and the southeast of England.

15.2.8 The National Networks NPS[1] (NN NPS) (Department for Transport, 2014) sets out the need for development of road, rail and strategic rail freight interchange projects on the national networks and the policy against which decisions on major road and rail projects will be made. This has been taken into account in relation to the highway improvements proposed as part of the Project.

15.2.9 Table 15.2.1 provides a summary of the relevant requirements of these NPSs and how these are addressed within this Chapter.

Table 15.2.1: Summary of NPS Information Relevant to this Chapter

Summary of NPS Requirement	How and where considered in the ES
Airports NPS	
(Paragraph 4.46) The range of impacts of climate change must be considered using the latest UK climate projections and appropriate mitigation or adaption measures identified.	The assessment identified climate change impacts using UK Climate Projections (UKCP18) (the latest set of UK climate change projections) (Met Office, 2018a), as described in Section 15.5 of this chapter. Sections 0 and 15.9 include information which sets out how embedded environmental measures would be implemented in relation to climate change.
(Paragraph 4.47) To assess the impacts of climate change, the applicant should apply the latest UKCP18 considering a scenario that reflects GHG emissions at the 10%, 50% and 90% probability levels.	The use of probability levels from the 10th to the 90th percentile, including the 50th percentile, is described in Section 15.5, specifically Table 15.5.5 and Table 15.5.6 of this assessment.

[1] The Department for Transport published a revised draft National Networks National Policy Statement for consultation on 14 March 2023. The draft NN NPS confirms in paragraph 1.16 that the existing NN NPS remains the relevant government policy and has full force and effect in relation to any applicable applications for development consent accepted for examination before designation of the updated NN NPS. The draft NN NPS further notes in paragraph 1.17 that the emerging draft NN NPS is capable of being an important and relevant consideration in the SoS decision making process. As such, the Applicant will continue to monitor the progress of the NN NPS review process and incorporate any updates to the Project's application documentation where considered appropriate in due course.

Summary of NPS Requirement	How and where considered in the ES
(Paragraph 4.48) There should be no critical features of infrastructure design which may be seriously affected by more radical changes to climate beyond those projected in the latest UKCP18.	In preparing this ES, climate model outputs from the UKCP18 have been used and the assessment has used proportionate and appropriate methods considered to be suitable at this time, as described in Section 15.5. More radical changes have been assessed through use of the latest UKCP18 Probabilistic Projections of Climate Extremes (PPCE). These assessments took the form of a sensitivity analysis and have been included in Section 15.5 and more details are set out in **ES Appendix: 15.5.1: Sensitivity Analysis – Climate Extremes** (Doc Ref. 5.3). Such models can help consider possible future climate scenarios or outcomes, but no model that attempts to project the future can do so with certainty, and actual events may not occur as projected. Critical features of infrastructure design have been assessed against those projected in the latest UKCP18 (Met Office, 2018a), see Section 0 CCR Assessment (and **ES Appendix: 15.8.1 Climate Change Resilience Assessment** (Doc Ref. 5.3)) and Section 15.9 ICCI Assessment (and **ES Appendix: 15.9.1 In-combination Climate Change Impacts Assessment** (Doc Ref. 5.3)).
(Paragraph 4.49) Adaptation measures should be based on the latest UKCP18, most recent UK CCRA, consultation with statutory bodies and any other appropriate data.	The consideration of the UK CCRA (Defra, 2017) in the methodology is described in Section 15.5 . Table 15.3.1 and Table 15.3.2 set out the responses to Planning Inspectorate (PINS) comments and the summary of consultation in response to the PEIR respectively. Full details of the consultation response to the PEIR can be found in **ES Appendix 15.3.2: Summary of Stakeholder PEIR Responses – Climate Change** (Doc Ref. 5.3). Table 15.3.3 outlines engagement with key stakeholders. Further mitigation measures have been developed to manage risks. These are described in Sections 0 and 15.9.
(Paragraph 4.50) If any proposed measures give rise to consequential impacts, the SoS will consider the impact in relation to the application as a whole and the principles of the Airports NPS.	The consequential impacts of embedded mitigation for other environmental aspects (e.g. on health and wellbeing) have been assessed in individual topic chapters within this ES. Mitigation identified for climate change has been recorded in Table 15.8.4 and 15.9.1 for the CCR Assessment and for the ICCI Assessment, respectively.

Summary of NPS Requirement	How and where considered in the ES
(Paragraph 4.51) Adaptation measures can be implemented at the time of construction where necessary.	Elements of the design have been developed to account for climate change adaption and would be implemented at the time of construction. These are captured within the **Design and Access Statement** (DAS) (Doc Ref. 7.3) as Outline Climate Resilience Design Principles and measures.
(Paragraph 4.52) The SoS can require the applicant to ensure that adaptation measures be implemented should the need arise, rather than at the outset of the development.	Several mitigation measures are already embedded within the design of the Project. Embedded mitigation measures are necessary for four key areas (overheating in buildings during construction, dealing with extreme events during construction, overheating in buildings during operation and water stress during operation) and these are identified within the **Design and Access Statement** (Doc Ref. 7.3). Should other climate risks become significant in the future, see Paragraph 15.8.17 and the **ES Appendix 15.8.1: Climate Change Resilience Assessment** (Doc Ref. 5.3) that has suggested additional mitigation should the need arise.
National Networks NPS[2]	
Paragraph 4.37 of the NPS is of relevance to the CCR assessment and ICCI: '*how the NPS puts Government policy on climate change adaptation into practice, and in particular how applicants and the SoS should take the effects of climate change into account when developing and consenting infrastructure.'* The NPS wording is similar to that in the Airports NPS except in paragraph 4.41 which specifies that: *'where transport infrastructure has safety-critical elements and the design life of the asset is 60 years or greater, the applicant should apply the UK Climate Projections 2009 (UKCP09) high emissions scenario (high impact, low likelihood) against the 2080 projections at the 50% probability level*.'	The assessment used UKCP18 projections (Met Office, 2018a) (which have superseded the UKCP09 projections) using Representative Concentration Pathway (RCP) 8.5 emissions scenario ('high') across the range of probability levels from the 10th to the 90th percentile, and therefore the assessment included the 50th percent probability level.

[2] The Transport Decarbonisation Plan published by Department for Transport (DfT) on 14 July 2021 announced DfT's intention to review the NN NPS in due course once demand patterns post-pandemic become clearer. It is understood DfT's review is underway, with a previous stated intention to complete such review by Spring 2023. Revised timescales for the completion of the review are not known; however, in the interim and whilst the review is undertaken, DfT has confirmed the NN NPS remains relevant government policy and has full force and effect for the purposes of the Planning Act 2008. The Applicant will continue to monitor the review process and reflect any necessary updates to the application for development consent for the Project as are considered appropriate at the time.

National Planning Policy Framework

15.2.10 The National Planning Policy Framework (NPPF) (Department for Levelling Up, Housing & Communities, 2021[3]) sets out the planning policies for England. Chapter 14 of the NPPF (Meeting the challenge of climate change, flooding and coastal change) sets out the approach to meeting the challenge of climate change.

15.2.11 Paragraph 156 of the NPPF states that: '*New development should be planned for in ways that: a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure…*'.

15.2.12 Paragraph 159 states that: '*in determining planning applications, local planning authorities should expect new development to: a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable…*'.

15.2.13 The NPPF requires a risk-based approach to avoid vulnerability associated with flood risk and climate change. Sections 0 and 15.9 of this chapter outline the methodologies that were used to ensure that the vulnerability of the Project to climate change was assessed, and environmental measures would be implemented to ensure risks are managed that are used in the **ES Appendix 11.9.6: Flood Risk Assessment** (Doc Ref. 5.3) and **ES Appendix 11.9.6: Flood Risk Assessment Annex 6** (Doc Ref. 5.3) (Flood Resilience Statement).

Other Relevant National Planning Policy

15.2.14 The Flood Risk and Coastal Change guidance within the National Planning Practice Guidance (NPPG) (Ministry of Housing, Communities and Local Government, 2014) contains climate change allowances to be included in Flood Risk Assessments (FRA). These allowances take the form of percentage uplifts for streamflow and precipitation for proposed drainage design.

15.2.15 2018 Beyond the Horizon – Making best use of existing runways (Department for Transport, 2018d) sets out the Government's support for airports (other than Heathrow) making best use of their existing runways subject to related economic and environmental considerations being taken into account.

15.2.16 The Jet Zero strategy: Delivering net zero aviation by 2050 (Department for Transport, 2022) sets out the UK government's strategy for achieving Net Zero aviation emissions by the year 2050. It states that carbon markets and GHG removals will be needed to address residual emissions and achieve Net Zero emissions and commits to support 'sustainable airport growth'. The Strategy states that the Government will take such measures as are necessary to meet its targets but that the sector can achieve Jet Zero without the Government needing to intervene directly to limit aviation growth, with knock-on economic and social benefits.

Local Planning Policy

15.2.17 Gatwick Airport lies within the administrative area of Crawley Borough Council and adjacent to the boundaries of Mole Valley District Council to the north west, Reigate and Banstead Borough

[3] This document was under consultation until March 2023 and is currently being reviewed and updated.

Council to the north east and Horsham District Council to the southwest. The administrative area of Tandridge District Council is located approximately 1.9 km to the east of Gatwick, while Mid Sussex District Council lies approximately 2 km to the southeast. Gatwick is located in the county of West Sussex and adjacent to the county of Surrey.

15.2.18 The most relevant local planning policies that are applicable to climate change and taken into account for the assessment are summarised in Table 15.2.2 and explained further in **ES Appendix 15.2.1: Summary of local planning policy – Climate Change** (Doc Ref. 5.3). For some environmental topics that have informed this chapter, a wider study area has been used and therefore policies in local plans over a wider area have been considered, where appropriate.

Table 15.2.2: Local Planning Policy

Administrative Area	Plan	Policy
Adopted Policy		
Crawley	Crawley 2030: Crawley Borough Local Plan 2015-2030 (2015)	ENV6: Sustainable design and construction
		GAT1: Development of the Airport with a Single Runway
		SD1: Presumption in favour of sustainable development
Reigate and Banstead	Reigate and Banstead Local Plan: Core Strategy 2014 (Reviewed 2019)	CS10: Sustainable development
		CS11: Sustainable construction
	Reigate and Banstead Development Management Plan 2019	OSR2: Open space in new developments
		CCF2: Flood risk
Mole Valley	Mole Valley Core Strategy 2009	CS19: Sustainable Construction, Renewable Energy and Energy Conservation
Horsham	Horsham District Planning Framework 2015	Policy 35: Climate change
		Policy 37: Sustainable design and construction
Tandridge	Tandridge District Core Strategy 2008	CSP14: Sustainable construction
		CSP15: Environmental quality
	Tandridge Local Plan Part 2: Detailed Policies 2014-2029 (2014)	DP21: Sustainable Water Management
Mid Sussex	Mid Sussex District Plan 2014-2031	DP39: Sustainable Design and Construction
	Site Allocations Development Plan Document (2020)	SA GEN: General Principles for Site Allocations: Biodiversity and Green Infrastructure
		SA GEN: General Principles for Site Allocations: Flood risk and drainage
		SA GEN: General Principles for Site Allocations: Sustainability

Administrative Area	Plan	Policy
West Sussex County Council	West Sussex Waste Local Plan (2014)	W12: High quality developments
Surrey County Council	Surrey Waste Local Plan 2019-2033 (2020)	Surrey Local Transport Plan 2022- 2032 (LTP4) (2021) Minerals and Waste Local Plan: Issues and Options Consultation (2021)
Emerging Policy		
Crawley	Submission Draft Crawley Borough Local (2021) Plan 2021-2037: Regulation 19 consultation	Strategic Policy SD1: Presumption in Favour of Sustainable Development
		Strategic Policy SDC1: Sustainable Design and Construction
		Policy EP1: Development and Flood Risk
Mole Valley	Future Mole Valley 2020-2037 Proposed Submission Version (2021)	Policy S1: Presumption in Favour of Sustainable Development
		Policy EN14: Responding to the Climate Emergency
		Policy INF2: Managing Flood Risk
Horsham	Draft Horsham District Local Plan 2019-2036: Regulation 18 Consultation (2020)	Strategic Policy 1: Sustainable Development
		Strategic Policy 37: Climate Change
		Strategic Policy 40: Flooding
Tandridge	Our Local Plan: 2033 (Regulation 22 Submission) (2019)	TLP30: Green and Blue Infrastructure
		TLP47: Sustainable Drainage and Reducing Flood Risk

15.3. Consultation and Engagement

15.3.1 In September 2019, Gatwick submitted a Scoping Report (Gatwick Airport Ltd (GAL), 2019) to the Planning Inspectorate (PINS), which described the scope and methodology for the technical studies being undertaken to provide an assessment of any likely significant effects and, where necessary, to determine suitable mitigation measures for the construction and operational periods of the Project. It also described those topics or sub-topics which are proposed to be scoped out of the EIA process and provided justification as to why the Project would not have the potential to give rise to significant environmental effects in these areas. This is provided in **ES Appendix 6.2.1: Scoping Report** (Doc Ref 5.3).

15.3.2 Following consultation with the statutory bodies, the PINS (on behalf of the SoS) provided a **Scoping Opinion** on 11 October 2019 (PINS, 2019). This **Scoping Opinion** is provided in ES Appendix 6.2.2 (Doc Ref. 5.3).

15.3.3 Key issues raised during the scoping process specific to climate change are listed in Table 15.3.1, together with details of how these issues have been taken into account within the ES. The table shows the responses from the PINS. Responses from other stakeholders are presented in **ES Appendix 15.3.1: Summary of Stakeholder Scoping Responses – Climate Change** (Doc Ref. 5.3).

Table 15.3.1: Summary of Scoping Responses

Details	How/where taken into account in ES
Include a description and assessment of significant effects on climate and vulnerability of project to climate change	See Sections 0 and 15.9 for the vulnerability of the project to climate change. The description and assessment of significant effects on climate are addressed in **ES Chapter 16: Greenhouse Gases** (Doc Ref. 5.1).
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.	The assessment is based on the design as described in **ES Chapter 5: Project Description** (Doc Ref. 5.1). In some cases, adaptive capacity has already been incorporated into the design of certain assets, for example the inclusion of flood resilience measures for surface access assets (see **ES Appendix: 15.9.1: In-combination Climate Change Impacts Assessment** (Doc Ref. 5.3)). Details of the embedded mitigation measures that reflect the Project's adaptive capacity have been included as part of the CCR assessment (see **ES Appendix 15.8.1: Climate Change Resilience Assessment** (Doc Ref. 5.3)) and listed in Table 15.8.4. As the project design is further refined at detailed design stage (to follow post Development Consent Order (DCO) consent), its adaptive capacity would be further considered. This assessment has been informed by any specific requirements with respect to adaptive capacity, whether in relation to climate resilience or other factors.
The baseline should be presented within the ES, with appropriate referencing to the existing reports.	The baseline environment is described in Section 15.5.

Details	How/where taken into account in ES
Explain the applicability of the existing Adverse Weather Plan (AWP) and Flood Management Plan to the assessment of likely significant effects from the Proposed Development and how adherence will be secured.	Embedded mitigation included as part of the existing Gatwick Airside AWP (GAL, 2021b) (which also applies to the Project) has been considered within the CCR assessment and the assessment of significance (see **ES Appendix 15.8.1: Climate Change Resilience Assessment** (Doc Ref. 5.3)) and the ICCI assessment (see **ES Appendix 15.9.1: In-combination Climate Change Impacts Assessment** (Doc Ref. 5.3)). A commitment to the continuation of the AWP and its adherence is relied upon for the climate change assessment during operation. The existing plan (and any relevant updates) is secured as an existing legislation (UK Civil Aviation Authority (CAA) Regulations). Gatwick Airport is required to have an AWP, as per UK Civil Aviation Authority regulations. This Plan is prepared to preserve passenger, operational safety and business continuity. For the purposes of the CCR assessment during the operational period, it has been assumed that GAL would commit to continuing its Gatwick Airside AWP (GAL, 2021b) and enhance it as needed to consider a changing climate, following Eurocode good practice for both AWPs (Eurocontrol, 2021a) and managing climate risks (Eurocontrol, 2021b). A Flood Resilience Statement is included in the **ES Appendix 11.9.6: Flood Risk Assessment Annex 6** (Doc Ref. 5.3). There is also a relevant extraction from GAL's Drainage Strategy report as part of **ES Chapter 11: Water Environment** (Doc Ref. 5.1). These flooding and drainage aspects take future climate change into account and are applied directly to the embedded design. Commitment and adherence to the Flood Resilience Statement and Drainage Strategy is relied upon for the climate change (and water environment) assessment. They are secured as requirements of the draft DCO.
Use the most up to date Climate Change projection information available and set out the assumptions and uncertainties in all future projections. Explain how future climate conditions have influenced the design of the Proposed Development.	The latest UKCP18 data (Met Office, 2018a) has been used in the assessment. Details of the data used can be found in Section 15.5. The impact of future climate change conditions on the design of the Project has been described in Sections 0 and 15.9. Future climate conditions have influenced the design of the Project around expected projected changes in precipitation and subsequently surface runoff and flooding, where Environment Agency (EA) guidance has been followed.

Details	How/where taken into account in ES
The ES should explain how climate change risks relate to the assessment of likely significant effects. Any design commitments that are relied upon to ensure no high risks to the Proposed Development should be appropriately described and secured.	See Sections 0 and 15.9. Paragraphs 15.9.11-15.9.12 explain how the impacts of climate change on existing effects may exacerbate significant effects. The design commitments that are relied upon are described and secured in Paragraphs 15.8.7-15.8.9 and Table 15.8.4 for the CCR Assessment, and in Paragraph 15.9.15 and Table 15.9.1; alongside the approach to embedded mitigation.
The ES should consider effects from increased heat (including 'heat island' effects) such as from thermal emissions from increased ATMs and heating and power plant where significant effects are likely to occur.	An urban heat island (UHI) assessment has been undertaken (see Section 15.5 **and ES Appendix 15.5.2: Urban Heat Island Assessment** (Doc Ref. 5.3)). Where appropriate, the impacts of increased heat have been considered in the **ES Appendix 15.9.1: In-combination Climate Change Impacts Assessment** (Doc Ref. 5.3).
The Inspectorate agrees that a separate consideration of sunlight/daylight is not required. As the operational air quality assessment findings were unknown at that stage (in particular effects of the increased ATMs, road traffic and biomass boiler on local air quality) the Inspectorate considers that where significant effects are likely to occur (as may be demonstrated by the emerging air quality assessment) microclimatic effects should be assessed within the ES.	The assessment undertaken for the ES for construction and operation concludes that no significant air quality effects are predicted (**ES Chapter 13: Air Quality** (Doc Ref. 5.1)), therefore microclimatic effects were not assessed.

15.3.4 The PEIR was issued to inform the statutory consultation carried out on the Project in Autumn 2021. It presented the preliminary findings of the EIA process for the Project at that time. The consultation responses specific to the climate change assessment and the way in which they have been taken into account in this ES chapter are summarised in the following table (Table 15.3.2) and **ES Appendix 15.3.2: Summary of Stakeholder PEIR Responses – Climate Change** (Doc Ref. 5.3). Further detail about the consultation process for the Project and the way the consultation responses have been addressed is provided in the separate Consultation Report.

Table 15.3.2: Summary of Consultation in Response to the PEIR

Consultee	Key Themes	How taken into account in the ES
West Sussex County Council	Concerns over a UHI effect created by Gatwick and how this may be exacerbated by the Project	An UHI Assessment for the Project concludes that the Project would not create a new UHI effect, but that the increased impervious surface cover and buildings due to the extension of the taxiways, hotels and car parks, among other features alongside projected increases in temperature from climate change could exacerbate the increase in the UHI effect at the Project site itself, particularly at night. However, this UHI effect is low (Section 15.5.28 and **ES Appendix 15.5.2: Urban Heat Island Assessment** (Doc Ref. 5.3)).
Horsham District Council; East Sussex County Council; Sussex Wildlife Trust; AECOM	The need for the CCR and ICCI assessments to be supplemented by detailed mitigation measures, beyond high level embedded mitigation measures, to ensure secure mitigation post-DCO. More detail on mitigation measures could include the route to implementation alongside monitoring of implementation and effectiveness.	The ES does not identify any further mitigation measures (in addition to embedded mitigation that is part of the Project and adherence to existing legislation) as there are no high and very high risks. Where embedded mitigation is accounted for via design commitments, mechanisms are included to show where this mitigation is secured (see Table 15.8.4). Outline Climate Resilience Design Principles have been prepared to ensure CCR measures would be integrated into later design stages (after consent) and throughout operation (see Design Principles in the **Design and Access Statement** (Doc Ref. 7.3), **ES Appendix 5.3.2: Code of Construction Practice** and **ES Appendix 5.3.2: CoCP Annex 1 - Water Management Plan** (Doc Ref. 5.3).
National Highways	The need for the CCR assessment to take account of strategic road network (SRN) infrastructure	The CCR Assessment has considered the SRN (see **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1)) and subsequently assessed as part of the ICCI assessment.
Betchworth Parish Council; Brockham Parish Council; Surrey County Council; EA	The need to produce a FRA and for modelling of flood risk to factor in the consequences of climate change. Surface water and fluvial flooding mitigation measures should be designed in alignment with this assessment.	The Project complies with national planning policy around FRA and includes mitigation measures (additional drainage attenuation tanks to store additional runoff and floodplain compensation areas to store displaced fluvial floodwater) to ensure that there is no increase in flood risk to other parties, including an allowance for the predicted impacts of climate change. EA climate change allowances (2022) have informed the basis of the design to reduce flood risk.

Consultee	Key Themes	How taken into account in the ES
Historic England	The potential effect of climate change on groundwater conditions and the subsequent effects on archaeological preservation environments	These effects are considered in Section 6 of **ES Chapter 7: Historic Environment** (Doc Ref. 5.1). ICCI regarding change in groundwater conditions is also part of the **ES Appendix 15.9.1: In-combination Climate Change Impacts Assessment** (Doc Ref. 5.3) under the Historic Environment. Potential change on groundwater conditions is considered unlikely.
West Sussex County Council	Recommendation for the ICCI of heat undermining foundations and damaged buildings to be considered	ICCI regarding building foundations is part of the **ES Appendix 15.9.1: In-combination Climate Change Impacts Assessment** (Doc Ref. 5.3) under the Historic Environment. Potential shrinkage in drought conditions is considered unlikely.
West Sussex County Council	Need to clarify impact scoring of ICCI	In addition to the full **ES Appendix 15.9.1: In-combination Climate Change Impacts Assessment** (Doc Ref. 5.3), the methodology and approach to impact scoring is set out in Section 15.9.
West Sussex County Council	Need for a cumulative assessment	A cumulative assessment has not been undertaken within section 15.10, see section 15.10 for explanation. Heathrow expansion is not being considered for the main assessment due partly to the level of uncertainty associated with it. It is addressed as a separate sensitivity test to the cumulative effects assessment in **ES Chapter 20: Cumulative Effects and Inter-relationships** (Doc Ref. 5.1) in the event it does come forward.
AECOM	The need to present key documentation used, referencing all appropriate existing reports	A full list of key documentation referenced is provided in Section 15.13 References**.**

15.3.5 In June 2022 an additional consultation was undertaken to update stakeholders and the local community on the ongoing work and refinement to the Project proposals, which included a targeted, statutory consultation on the design changes to the proposed highway improvement changes. As these changes to the Project could lead to new or materially different significant environmental effects compared to those reported in the PEIR, an updated preliminary environmental information (PEI) was issued as part of this additional consultation. No consultation responses specific to the climate assessment were received.

15.3.6 Outside of the above-described public consultations, GAL also continued to engage with key stakeholders and during such engagement, key issues raised specific to the climate assessment are listed in Table 15.3.3 together with details of how these issues have been taken into account within the ES.

Table 15.3.3: Summary of Consultation and Engagement

Consultee	Date	Details	How/where taken into account in ES
Wider Stakeholders			
Crawley Borough Council, Reigate and Banstead Borough Council, Mole Valley District Council, West Sussex County Council, Surrey County Council, Horsham District Council, Mid Sussex County Council, East Sussex County Council, Kent County Council	28 August 2019	Presentation on the scope, data and method of the assessment. No issues arose for the CCR and ICCI assessments.	No change was made to the scope of the assessment in response to this.
Brighton and Hove City Council, Wealden District Council, Sevenoaks District Council, Royal Borough of Windsor and Maidenhead, Greater London Authority, Highways England, Historic England, Charlwood Parish Council, Horley Town Council	3 September 2019	Meeting on the scope of EIA topic assessment for air quality, climate change and carbon topics	No issues arose for the assessment of climate change.
Crawley Borough Council, Reigate and Banstead Borough Council, Mole Valley District Council, West Sussex County Council, Surrey County Council, Horsham District Council, Mid Sussex District Council	27 January 2020	The purpose of the meeting was to provide an update on emerging findings of the assessment (at that time), ahead of the then planned statutory consultation in Spring 2020.	Whilst questions were asked about the assessment no further issues arose for the assessment of climate change.

Consultee	Date	Details	How/where taken into account in ES
Crawley Borough Council, Surrey County Council, Reigate and Banstead Borough Council, Tandridge District Council, Horsham District Council, Mid Sussex District Council, East Sussex County Council, Kent County Council, West Sussex County Council	12 August 2021	The purpose of the meeting was to provide an update on emerging findings of the assessment ahead of the statutory consultation in Autumn 2021.	Whilst questions were asked about the assessment no further issues arose for the assessment of climate change.
Topic Working Group #2: Crawley Borough Council, Horsham District Council, Mid Sussex District Council, Reigate and Banstead District Council, East Sussex County Council, Surrey County Council and West Sussex County Council.	7 November 2022	Presentation given on the assessment Approach to CCR organised by: • CCR Assessment • ICCI Assessment • new work to feed into CCR and ICCI Assessments - UHI assessment and Sensitivity Testing • additional climate information. Discussion was held on: • physical assets to be assessed • wider social and health impacts of climate change • extreme events • future scenario time period • macro-scale socio-economic impacts • effect of temperature on the performance of the aircraft/aircraft engines, in relation to air quality and GHGs	The relevant points were taken into account during the preparation of the ES and details of the CCR methodology and ICCI methodology are included in Sections 15.8 and 15.9 respectively. The approach and results of the UHI assessment, are reported in **ES Appendix 15.5.2: Urban Heat Island Assessment** (Doc Ref. 5.3). The modelling does account for temperature in the calculations, but the same meteorology as in the base year is assumed (**ES Chapter 13: Air Quality** (Doc Ref. 5.1)).

Consultee	Date	Details	How/where taken into account in ES
		• UHI assessment urban baseline • extreme weather in regard to procurement, staff availability and security	
AECOM Summary Note following TWG Meeting 2: Assessment approach to Climate Change Risk 7th November 2022	7 November 2022	Technical note summarising the TWG. Meeting 2: Assessment approach to Climate Change Risk, including questions on: • which scenarios • how assets were identified • design lives • existing assets • criteria to assess consequences and alignment with Gatwick's Third Adaptation Reporting Power (ARP3) report (GAL, 2021).	The relevant points were taken into account during the preparation of the ES and details of the CCR methodology and ICCI methodology are included in Sections 15.8 and 15.9 respectively.
Topic Working Group #4: Crawley Borough Council, Horsham District Council, Mid Sussex District Council, Reigate and Banstead District Council, East Sussex County Council, Surrey County Council and West Sussex County Council.	18 January 2023	Presentation given on: • Introduction and recap on CCR assessment approach • Draft CCR - mitigation approach and measures • CCR assessment mitigation • ICCI assessment mitigation • Draft Climate Change Adaptation Strategy[4] Discussion was held on: • combination of effects • existing mitigation altered by the Project • overheating guidance	The relevant points were taken into account during the preparation of the ES and details of the CCR methodology and ICCI methodology are included in Sections 15.8 and 15.9 respectively. These risks are captured in the **ES Appendix 15.8.1: Climate Change Resilience Assessment** (Doc Ref. 5.3) and **ES Appendix 15.9.1: In-combination Climate Change Impacts Assessment** (Doc Ref. 5.3) and paragraphs

[4] This strategy was subsequently superseded by the mitigation included in the **ES Appendix 5.3.2: Code of Construction Practice** (Doc Ref. 5.3) and the **Design and Access Statement** (Doc Ref. 7.3).

Consultee	Date	Details	How/where taken into account in ES
		• number of high risks • sharing of the Draft Climate Change Adaptation Strategy[4].	15.8.17 and 15.9.23 which contains future monitoring for medium risks.

15.4. Relevant Guidance and Scope of the Assessments

Relevant Guidance

15.4.1 In addition to the requirements of the EIA Regulations, a number of other guidance documents are relevant to CCR and ICCI. The updated Design Manual for Roads and Bridges (DMRB) provides standards for the assessment of highways schemes. The DMRB underwent an update in 2019 and now contains a separate section on climate (GHG emissions and CCAR) (Highways England *et. al.*, 2019). The revised DMRB text is in line with the guidance from the ANPS and therefore the assessment of this chapter already reflects the requirements of the updated revised DMRB.

15.4.2 Other guidance documents that have been considered in the assessment process include:

- Guidance on Climate Change Resilience and Adaptation (Institute of Environmental Management and Assessment (IEMA), 2020);
- Environmental Report 2010, Chapter 6: Adaptation (International Civil Aviation Organization (ICAO), 2010);
- Climate Change Adaptation Planning: Risk Assessments for Airports (Airports Cooperative Research Programme (ACRP), 2015);
- Review of Operational Resilience at Heathrow and Gatwick (CAA, 2014);
- Climate Change Adaptation Report CAP 1363 (CAA, 2015);
- Climate Change Adaptation Report – At Gatwick Airport (GAL, 2011);
- Climate Change Adaptation Progress Report (GAL, 2016);
- Climate Change Adaptation Progress Report (GAL, 2021a);
- UK Climate Change Risk Assessment Evidence Report (Committee on Climate Change, 2017);
- Technical Memorandum 49: Design Summer Years for London (Chartered Institution of Building Services Engineers (CIBSE), 2014); and
- UKCP18 Science and user guidance reports (Met Office, 2018b).

Scope of the Assessment

15.4.3 The scope of this ES has been developed in consultation with relevant statutory and non-statutory consultees as detailed in Paragraphs 15.3.1 to 15.3.3 and Table 15.3.3 (see **ES Appendix 15.3.1: Summary of Stakeholder Scoping Responses – Climate Change** (Doc Ref. 5.3), Paragraph 1.1.2 and Section 2 for further details). The scope is also informed by the consultation on the PEIR in 2021 as detailed in Paragraph 15.3.4 and Table 15.3.2 (see **ES Appendix 15.3.2: Summary of Stakeholder PEIR Responses – Climate Change** (Doc Ref. 5.3), Paragraph 1.1.2, and Section 2 for further details).

15.4.4 Taking into account the scoping and consultation process, Table 15.4.1 summarises the issues considered as part of this assessment.

Table 15.4.1: Issues Considered within the Assessment

Activity	Potential Effects
Construction Period	
Construction and demolition activities within the existing airport boundary and construction of upgraded highway junctions	Extreme weather/climatic events (winds, heatwaves, low temperatures, droughts, intense rainfall events, lightning) exacerbating health and safety of construction workers and impacts on nearby sensitive community receptors (CCR and ICCI assessments).
	Extreme weather/climatic events (winds, heatwaves, low temperatures, droughts, intense rainfall events, lightning) exacerbating environmental impacts to air, land, biodiversity, water, and human health receptors (ICCI assessment).
Delivery of construction and demolition activities within existing airport boundary, including construction of upgraded highway junctions	Extreme weather/climatic events (winds, heatwaves, low temperatures, droughts, intense rainfall events, lightning) negatively affecting performance of construction equipment/delays to construction programme (CCR assessment).
Operational Period	
Performance of the Project with respect to climate change resilience and adaptation.	Change in seasonal patterns (rainfall and temperatures) affecting soil moisture, flora growing season, green infrastructure (ICCI and CCR assessments).
	Extreme weather/climatic events (winds, heatwaves, low temperatures, droughts, intense rainfall events, lightning) exacerbating environmental impacts to air, land, biodiversity, water, and human health receptors (ICCI assessment).
	UHI (ICCI and CCR assessments).
	Change in seasonal patterns (rainfall and temperatures) affecting health and safety (CCR assessment).
	High temperatures, heatwave, high intensity rainfall events, snowfall, lightning and/or flooding affecting aircraft operations, airport infrastructure (eg, drainage), utilities/service resilience and upgraded highway junctions (CCR assessment).
Mitigation areas beyond existing airport boundary	Change in seasonal patterns (rainfall and temperatures) affecting soil moisture, flora growing season, green infrastructure (ICCI assessment).

Activity	Potential Effects
	Extreme weather/climatic events (winds, heatwaves, low temperatures, droughts, intense rainfall events, lightning) exacerbating environmental impacts to air, land, biodiversity, water, and human health receptors (ICCI assessment).
	UHI (ICCI and CCR assessments).

15.4.5 The definitions that have been used to define the asset and asset types for the Project and the hazards that have been scoped in as part of the CCR assessment are included in **ES Appendix 15.4.1: Climate Change Resilience Definitions** (Doc Ref. 5.3).

15.4.6 For the ICCI assessment, a list of the topics and receptors scoped in can be found in **ES Appendix 15.4.1: Climate Change Resilience Definitions** (Doc Ref. 5.3). The ICCI assessment has been deemed as not relevant to Major Accidents and Disasters (see **ES Appendix 5.3.4: Major Accidents and Disasters** (Doc Ref. 5.3)) because a consideration of climate change is included as part of the natural hazards assessment.

15.4.7 Effects which are not considered likely to be significant, and the decommissioning stage, have been scoped out of the assessment. For the CCR assessment, effects of sea level rise have been scoped out due to the inland location of Gatwick, which means it is not at risk of coastal flooding. In its scoping opinion, PINS has agreed to sea-level rise and micro-climatic effects being scoped out of the assessment (PINS, 2019), however the presence and effect of a potential UHI was assessed for the ES following and informed by the stakeholder consultation.

Study Area

15.4.8 The study area for the CCR assessment is the Project site boundary. The construction assessment also includes any areas of land required temporarily for construction. **ES Figure 1.3.1** (Doc Ref. 5.2) shows the Project site boundary.

15.4.9 The study area for the ICCI assessment corresponds to the study area boundaries defined for each of the environmental topics considered in the EIA process (refer to all relevant chapters of this ES, from **ES Chapter 7: Historic Environment** (Doc Ref 5.1) to **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1)).

Temporal Scope

15.4.10 The potential impacts of climate change increase over time. Consequently, in the assessments of CCR and ICCI in this chapter, the potential impacts experienced by the receptor or asset would be largest at the end of the Project or asset design life. Where assets are assumed to be in operation in perpetuity, potential impacts would be greatest at the furthest extent of the UKCP18 projections (Met Office, 2018a).

15.4.11 Construction works are anticipated to commence in 2024 with a sequence of activities being undertaken during a period of 14 years. The 2020-2049 (2030s) time period (see paragraph 15.5.2) has been used for construction activities for both the ICCI and CCR assessments to represent a reasonable worst-case approach. It is noted however, that during this period there would also be operational activities of the Project post-2029.

15.4.12 For receptors or assets that are in place in perpetuity, the end of the twenty-first century is taken as the most relevant time to assess climate change impacts in-line with the UKCP18 projections (Met Office, 2018a). Therefore, the 'core' assessment years (key years relating to milestones in the construction and operation periods of the Project) are not relevant to the assessment. Instead, the assessment has used a later period, the 2050-2079 (2060s), as it represents a more conservative time period. This time period has been selected because information regarding extreme climate events for receptors and assets assessed in the CCR and ICCI assessments are not available in UKCP18 beyond 2079. The limitations of the CCR and ICCI assessments are described in Section 15.6. For highways related risks and assessments in **ES Chapter 12: Traffic and Transport** (Doc Ref. 5.1) and **ES Chapter 11: Water Environment** (Doc Ref 5.1), climate projections up to 2100 are used in accordance with the latest DMRB guidance.

15.5. Baseline Environment

15.5.1 This section details the methodology and assessment outcomes for the baseline period, which is relevant to both the CCR and ICCI assessments. The methods and outcomes for the CCR and ICCI assessments are detailed in Sections 0 and 15.9, respectively.

Methodology for Baseline Studies

Desk Study

15.5.2 Information regarding current and projected future climate conditions has been used in the ICCI and CCR assessments. Five sets of climate data have been assembled:

- current baseline climate conditions for 1981-2010– based on historical weather data;
- future climate scenario for 2020-2049 ('2030s') covering the construction period;
- future climate scenario for 2050-2079 ('2060s') covering operation;
- PPCE for current baseline (1981-2010) climate extremes; and
- PPCE for future ('2060s') climate extremes.

15.5.3 The climate datasets are based on the Met Office's UKCP18 (2018a), which are the most recent and comprehensive climate change projections for the UK. In addition to projections for future climate they also contain a comprehensive set of historical climate data. These datasets are described in more detail below.

15.5.4 The baseline data for the UHI assessment were compiled using the US National Oceanic and Atmospheric Administration (NOAA) temperature dataset for local weather stations. This ensured the 20-year period from 2002-2022 could be captured.

15.5.5 As mentioned above, the 2030s future time period encompasses the future baseline period for construction, whilst the 2060s future time period is used to assess a worst-case climate change scenario for the operational period of the Project for the receptors and assets assessed in the CCR and ICCI assessments.

15.5.6 The CCR assessment does not have a baseline as such, as it relates only to the new development. It has, however, been informed by assessments that have been carried out for the existing infrastructure of the airport by Gatwick through its Adaptation Reporting to Defra (GAL, 2011; 2016; 2021a).

Site-Specific Surveys

15.5.7 No site-specific surveys were conducted for the CCR and ICCI assessments.

Current Baseline Conditions

15.5.8 Information regarding historical climate conditions at Gatwick was obtained from the UKCP18 (Met Office, 2018a) observed climate datasets. All the data for the current baseline were obtained from this source.

Data resolution

15.5.9 A 12 km × 12 km grid resolution was used to obtain observed projections for all climate variables except relative humidity, which was collected from a 25 km × 25 km grid. The grid cell selected to collect the baseline climate data for Gatwick at the 12 km × 12 km grid resolution and the 25 km × 25 km grid resolution are presented in **ES Figure 15.5.1** (Doc Ref. 5.2) and **ES Figure 15.5.2** (Doc Ref. 5.2), respectively.

Average climate conditions

15.5.10 Seasonal climate averages for Gatwick are given in Table 15.5.1. The dataset was derived by analysis of observed weather timeseries from gridded datasets. The data is considered to be an accurate reflection of climate conditions at the airport as it is in a rural location and is understood not to experience a pronounced local microclimate. The CIBSE, (2014) guidance provides data for Gatwick which can be used to represent conditions in more rural areas around the edge of Greater London.

15.5.11 Seasonal climate averages for the 1981-2010 baseline show that Gatwick experiences a winter mean temperature of 4.6 °C, with winter minimum temperatures averaging a low of 1.4 °C. Summer at Gatwick shows a mean temperature of 16.3 °C with daily maximum temperatures averaging a high of 21.5 °C. Precipitation rates for Gatwick show that during winter, mean precipitation rates are 2.5 mm/day and lower at 1.7 mm/day during the summer months.

Table 15.5.1: Seasonal Climate Averages for the Gatwick Area

Parameter	Baseline 1981-2010
Winter mean temperature (°C)	4.6
Summer mean temperature (°C)	16.3
Winter mean daily minimum temperature (°C)	1.4
Summer mean daily maximum temperature (°C)	21.5
Winter mean precipitation rate (mm/day)	2.5
Summer mean precipitation rate (mm/day)	1.7

15.5.12 A 2021 local update report from the Met Office introduced fixed errors within the 2019 2.2km UK convection-permitting model (CPM), thereby enabling the development of accurate lightning and mean surface wind speed projections (Met Office, 2021). These projections simulate small scale behaviour seen in the atmosphere, in particular atmospheric convection, which is a key process

driving many of the UK's extreme weather events. A baseline period from 1981-2000 was used for comparison against future simulations for the period 2061-2080[5].

Extreme weather conditions

15.5.13 Information regarding occurrence of extreme weather events, including hot days, frost days, heavy rainfall and dry spells is given in Table 15.5.2. As with the seasonal climate averages data, the data within Table 15.5.2 was also obtained from the UKCP18 (Met Office, 2018a) observed climate datasets, meaning they were derived by the analysis of observed weather timeseries from gridded datasets. Again, the datasets are considered to be an accurate reflection of climate conditions at the airport as it is in a rural location and is understood not to experience a pronounced local microclimate. The datasets were analysed for the 30 year period (1981-2010), and for temperature and precipitation the number of events presented in the table is an average number of events per year. Thus, a value of 0.3 for heatwaves represents an occurrence of 9 heatwaves over 30 years. For relative humidity the absolute percentage is presented.

15.5.14 Historical extreme weather events for Gatwick show an average number of 54 frost days per year (across the 1981-2010 baseline). The average number of heatwaves at 0.3 per year represents an occurrence of 9 heatwaves over 30 years. Gatwick also experiences an average of 17 hot days per year. For dry spells, 10 days or more with no precipitation, Gatwick averages 5 per year and average 2 days a year of heavy rainfall (when precipitation is greater than 25 mm per day). Relative humidity is high in winter at 85% and lower in summer at 77% (Table 15.5.2).

Table 15.5.2: Historical Extreme Weather Events for the Gatwick Area

Parameter	Baseline 1981-2010
Average number of frost days (daily minimum temperature equal to or lower than 0°C) per year	54
Average number of heatwaves (two days with maximum temperature higher than 29°C and minimum temperature higher than 15°C) per year	0.3
Average number of hot days (daily maximum temperature higher than 25°C) per year	17
Average number of dry spells (10 days or more with no precipitation) per year	5
Average number of days per year when precipitation is greater than 25 mm per day (Met Office definition of 'heavy rain')	2
Relative humidity winter (%)	85
Relative humidity summer (%)	77

15.5.15 A sensitivity analysis has been undertaken that uses newer climate (not weather) extremes from the latest climate extremes dataset from the UK Met Office, testing the sensitivity of seasonal climate extreme maximum temperature, 1-day and 5-day precipitation rates; examining the projected extreme values of a 1 in 100-year event for each variable respectively.

[5] Only one baseline period is available for the UKCP Local (2.2km) projections, being 1981-2000. This is used in the UKCP science reports, headline findings, maps and graphs. It is not possible to utilise the 1981-2010 baseline period applied for the 25km resolution data analysis as it is not available. The logic was to use the most recent baseline periods available where possible across all UKCP datasets.

15.5.16 PPCE provide information on temperature and precipitation extremes across the UK for the 21st century. PPCE projections for current climate extremes were obtained from the UKCP18 Projections (Met Office, 2018a). A 25km x 25km grid resolution was used to obtain observed projections for three climate variables, daily maximum air temperature at 1.5m, daily maximum precipitation and 5-day accumulated precipitation. Projections were also developed for the lowest (driest) maximum daily maximum precipitation and 5-day accumulated precipitation, to act as an indicative assessment of trends in dry conditions. Seasonal extreme climate averages for Gatwick are presented in For the baseline period (1981-2010) for seasonal climate extremes, the worst case (95th percentile) extreme (1 in 100-year event) summer daily maximum temperature at Gatwick is 35.8℃. For autumn, spring, and winter, daily maximum air temperatures are 30.1 °C, 29.5 °C and 18.1 °C respectively. Current extreme daily maximum precipitation and driest maximum precipitation is highest during autumn (88.1 mm and 48.0 mm) and lowest in the spring (56.6 mm and 31.5 mm). The five-day maximum accumulated precipitation is 165.1mm during autumn and 91.0 mm in the spring, whereas the lowest 5-day maximum accumulated precipitation is 110.3 mm in autumn and 63.3 mm in spring (Table 15.5.3).

15.5.17 Table 15.5.3. The values represent the return level for an extreme event of a 1 in 100-year return period and provide actual values. The 95th percentile and 5th percentile have been chosen to represent the uncertainty range for the maximum and lowest maximum intensity of an event expected once within the 1 in 100-year return period, respectively. For more detail on the PPCE data and sensitivity analysis of climate extremes please see **ES Appendix 15.5.1: Sensitivity Analysis – Climate Extremes** (Doc Ref. 5.3). For the baseline period (1981-2010) for seasonal climate extremes, the worst case (95th percentile) extreme (1 in 100-year event) summer daily maximum temperature at Gatwick is 35.8℃. For autumn, spring, and winter, daily maximum air temperatures are 30.1 °C, 29.5 °C and 18.1 °C respectively. Current extreme daily maximum precipitation and driest maximum precipitation is highest during autumn (88.1 mm and 48.0 mm) and lowest in the spring (56.6 mm and 31.5 mm). The five-day maximum accumulated precipitation is 165.1mm during autumn and 91.0 mm in the spring, whereas the lowest 5-day maximum accumulated precipitation is 110.3 mm in autumn and 63.3 mm in spring (Table 15.5.3).

Table 15.5.3 Baseline (1981-2010) seasonal average Probabilistic Projections of Climate Extremes (PPCE) data

Parameter	Baseline 1981-2010
Daily maximum air temperature at 1.5m (°C) (95th Percentile)	
Autumn	30.1
Winter	18.1
Spring	29.5
Summer	35.8
1 day maximum precipitation (mm) (95th Percentile)	
Autumn	88.1
Winter	69.8
Spring	56.6
Summer	71.2
Driest 1 day maximum precipitation (mm) (5th percentile)	
Autumn	48.0
Winter	40.3
Spring	31.5
Summer	41.4
5 day maximum precipitation (mm) (95th percentile)	
Autumn	165.1
Winter	92.8
Spring	91.0
Summer	94.0
Driest 5 day maximum precipitation (mm) (5th Percentile)	
Autumn	110.3
Winter	81.1
Spring	63.3
Summer	71.0

Urban heat island effect

15.5.18 Whilst the CIBSE (2014) guidance document indicated that Gatwick does not experience a detectable UHI effect and the airport has a climate that is characteristic of its rural surroundings, an UHI assessment has been undertaken following stakeholder consultation on the topic. This

assessment compared the temperatures between an urban city location (London City Airport), a rural location (Charlwood) and Gatwick.

15.5.19 Evaluation of current conditions at these sites during average and heatwave conditions highlighted that day-time temperatures at the airport are slightly higher than those in a nearby rural site, although this difference is not pronounced (Charlwood; see Table 15.5.4). This effect was found to be particularly pronounced in night-time temperatures which are, on average, 1.0°C higher at Gatwick but 1.4°C higher during a heatwave event. However, this UHI effect is low. Further information can be found in **ES Appendix 15.5.2: Urban Heat Island Assessment** (Doc Ref. 5.3).

Table 15.5.4: Comparison of temperature values at the assessment site (Gatwick), an urban city location (London City Airport) and a rural location (Charlwood) using the NOAA dataset (2002-2022)

Weather station	Site	Summer average Day-time temperature (°C)	Summer average Night-time temperature (°C)	Summer heatwave event Day-time temperature (°C)	Summer heatwave event Night-time temperature (°C)
Gatwick Airport	Project site for assessment	19.9 (+0.3)	14.8 (+1)	34.9 (-0.7)	19.2 (+1.4)
London City Airport	Urban City	20.5 (+0.9)	16.9 (+3.1)	37.1 (+1.5)	23.1 (+5.3)
Charlwood	Rural	19.6	13.8	35.6	17.8

Brackets indicate temperature difference from Charlwood

Future Baseline Conditions

15.5.20 Information regarding future climate was obtained from the UKCP18 projections (Met Office, 2018a). The ANPS requires the high emissions scenario to be used. In UKCP09, one emissions scenario was termed 'high'; however, this is not the case in UKCP18, where emissions scenarios are referred to by the RCP value (Met Office, 2009, 2018b). The scenario with the highest level of GHG emissions in UKCP18 is RCP8.5 and so the GHG emissions scenario considered was RCP8.5[6].

15.5.21 Changes in the future values of climate averages were obtained from the probabilistic projections dataset on a 25 km × 25 km grid. The nearest grid cell to Gatwick was selected.

15.5.22 Information for other climate variables was obtained from timeseries analysis of the regional land surface projections at 12 km x 12 km resolution. The UKCP18 data (Met Office, 2018a) at 2.2 km grid resolution was not used because the increased resolution did not change the outcome of the assessment and therefore the 12 km grid resolution was considered sufficient.

[6] Representative Concentration Pathways (RCP) are used to model future climate and represent a broad range of climate outcomes based on different economic, social and physical assumptions. The RCPs can be represented by the levels of temperature change that result from each scenario. The RCP8.5 scenario represents a pathway where greenhouse gas emissions continue to grow unmitigated, leading to a global average temperature rise of 4.3°C by 2100. This is considered to be the worst case scenario (Met Office, 2018b).

15.5.23 The grid cells selected to collect the future climate data for Gatwick at the 12km x 12km resolution and 25km and 25km resolution are presented in **ES Figure 15.5.1** (Doc Ref. 5.2) and **ES Figure 15.5.2** (Doc Ref. 5.2), respectively.

Average climate conditions

15.5.24 Table 15.5.5 and Table 15.5.6 show the projected values for seasonal averages of temperature, precipitation and relative humidity in the two future climate periods. The datasets are presented as the average increase in number of days per year. The percentiles demonstrate low (10th), median (50th) and high (90th) estimates for future conditions. Note that in the calculation, the variables are treated as being independent. The datasets indicate that mean temperatures would increase, winter precipitation would increase, and summer precipitation would decrease in comparison with baseline temperatures recorded in Table 15.5.1.

15.5.25 Future seasonal climate averages for the 2030s are warmer across all seasons, with slightly wetter winters and slightly drier summers and are projected to show that Gatwick would experience a winter mean temperature of 5.5 °C (central value, 0.9 °C above the 4.6 °C baseline), with a wider range of 4.5 to 6.6 °C (from the 10th to the 90th percentiles respectively). Winter minimum temperatures are projected to average a low of 2.3 °C (central value, 0.9 °C above the 1.4 °C baseline) but could be as high as 3.4 °C (90th percentile). Summer in the 2030s at Gatwick shows a mean temperature of 17.7 °C (central value, 1.4 °C above the 16.3 °C baseline) but could be as high as 18.7 °C (90th percentile) with daily maximum temperatures averaging a high of 23.1 °C (central value, 1.6 °C above the baseline) yet are unlikely to average higher than 24.4 °C (95th percentile). Precipitation rates for Gatwick show that during winter, mean precipitation rates are expected to be slightly wetter at 2.7 mm per day and slightly drier at 1.5 mm per day during the summer months (Table 15.5.5).

Table 15.5.5: UKCP18 Climate Change Projections for Meteorological Changes for the Gatwick Area for the 2030s

Parameter	2020-2049 (RCP8.5 Percentile)		
	10th	50th	90th
Winter mean temperature (°C)	4.5	5.5	6.6
Summer mean temperature (°C)	16.8	17.7	18.7
Winter mean daily minimum temperature (°C)	1.2	2.3	3.4
Summer mean daily maximum temperature (°C)	22.0	23.1	24.4
Winter mean precipitation rate (mm/day)	2.4	2.7	3.0
Summer mean precipitation rate (mm/day)	1.1	1.5	1.8

15.5.26 Future seasonal climate averages for the 2060s are much hotter across all seasons, with wetter winters and drier summers and are projected to show that Gatwick would experience a winter mean temperature of 6.7 °C (central value, 2.1 °C above the 4.6 °C baseline), with a wider range of 5.3 to 8.3 °C (from the 10th to the 90th percentiles respectively). Winter minimum temperatures are projected to average a low of 3.6 °C (central value, 2.2 °C above the 1.4 °C baseline) but could be as high as 5.3 °C (90th percentile). Summer in the 2060s at Gatwick shows a mean temperature of 19.7 °C (central value, 3.4 °C above the 16.3 °C baseline) but could be as high as 21.8 °C (90th percentile) with daily maximum temperatures averaging a high of 25.4 °C (central

value, 3.9 °C above the 21.5 °C baseline) yet are unlikely to average higher than 28 °C (95th percentile). Precipitation rates for Gatwick show that during winter, mean precipitation rates are expected to be 0.4 mm per day wetter at 2.9 mm per day and 0.5 mm per day drier at 1.2 mm per day during the summer months (Table 15.5.6).

Table 15.5.6: UKCP18 Climate Change Projections for Meteorological Changes for the Gatwick Area for the 2060s

Parameter	2050-2079 (RCP8.5 Percentile)		
	10th	50th	90th
Winter mean temperature (°C)	5.3	6.7	8.3
Summer mean temperature (°C)	17.6	19.7	21.8
Winter mean daily minimum temperature (°C)	2.0	3.6	5.3
Summer mean daily maximum temperature (°C)	22.9	25.4	28.0
Winter mean precipitation rate (mm/day)	2.4	2.9	3.4
Summer mean precipitation rate (mm/day)	0.7	1.2	1.7

15.5.27 The 2021 local update report from the Met Office summarises the changes in lightning across the UK. The projections show that the southern part of the UK would experience an increase in the frequency of lightning during the summer, and to a lesser extent in spring, by the end of the century (2061-2080) compared to a 1981-2000 baseline under a high emissions scenario (RCP8.5) (Met Office, 2021). Summer increases are likely to be driven by deeper and more intense storms. In autumn, lightning frequency is expected to decrease, despite increases in precipitation extremes. This reduction would be caused by decreasing cloud ice content in future and the role that ice fluxes play in lightning generation. Little change in lightning frequency was identified during winter months. Subsequently, Gatwick can expect lightning frequency to increase during summer and spring and decrease during the autumn.

15.5.28 The new local update report also provides future projection for mean surface wind speeds. Mean surface wind speeds are projected to decrease over land in the southeast part of the UK in both winter and summer by the end of the century (2061-2080) when compared to a 1981-2000 baseline[10]. In the southeast of England, reduction in wind speeds would be greater in summer than winter. As a result, Gatwick would likely experience reduced wind speeds during winter and summer.

Extreme weather conditions

15.5.29 Table 15.5.7 and Table 15.5.8 contain projections for extreme weather events, including hot days, cold days, heavy rainfall, dry spells and relative humidity. The datasets were analysed for the 30 year periods and for temperature and precipitation the number of events presented in the table is an average number of events per year, with absolute percentage for relative humidity presented.

15.5.30 Table 15.5.8 shows that the frequencies of hot days, dry spells and heavy rainfall would all increase in the future compared to the baseline, whilst the number of cold days would decrease. Winter humidity is expected to remain similar to the baseline, with summer humidity decreasing slightly. This suggests hot day temperatures (>25°C) and heavy rainfall would pose an increased risk to Gatwick and cold temperatures would pose a decreased risk, and that the need for de-icing is likely to decrease. Whilst winters are expected to be become warmer on average, cold

weather spells would still occur up to and during the middle of this century and are expected to be the same magnitude and intensity as today.

15.5.31 The 2030s extreme weather events for Gatwick show fewer average number of 38 frost days per year (compared to the 54 days per year in the 1981-2010 baseline). The projected average number of heatwaves at 2 per year (the mean of the climate models, is an increase on the 0.3 per year over the baseline) but could expect as many as up to 5 a year on average worst case (the maximum value of the climate models). Gatwick is also expected to experience an average of 20 more hot days a year (37 hot days compared the 17 hot days per year for the baseline) but this could reach as high as 62 per year. For projected dry spells, 10 days or more with no precipitation, Gatwick is projected to average the same as the baseline at 5 per year (model mean and minimum) and average 2 days a year of heavy rainfall (when precipitation is greater than 25 mm per day) up to 4 days a year (model maximum). Relative humidity shows little to no change compared to the baseline is high in winter at 85% and lower in summer at 73% (Table 15.5.7).

Table 15.5.7: UKCP18 Projections for Future Extreme Weather Events for the Gatwick Area for the 2030s

Parameter	2030s (2020-2049)		
	RCP8.5 Min	RCP8.5 Mean	RCP8.5 Max
Average number of frost days (daily minimum temperature equal or lower than 0°C) per year	29	38	49
Average number of heatwaves (two days with maximum temperature higher than 29°C and minimum temperature higher than 15°C) per year	0.2	2	5
Average number of hot days (daily maximum temperature higher than 25°C) per year	23	37	62
Average number of dry spells (10 days or more with no precipitation) per year	5	5	7
Average number of days per year when precipitation is greater than 25 mm per day (Met Office definition of 'heavy rain')	1	2	4
Relative humidity winter (%)	85	85	86
Relative humidity summer (%)	70	73	75

RCP8.5 Min, Mean and Max refer to the model ensemble minimum, mean and maximum values across the 12 models in the 12km Regional UCKP18 data. 0.2 value for the heatwave is essentially once every 5 years.

15.5.32 The 2060s extreme weather events for Gatwick show over 50% less average number of frost days per year (25 compared to the 54 days per year in the 1981-2010 baseline). The projected average number of heatwaves at 8 per year (the mean of the climate models, is an increase on the 0.3 per year over the baseline) but could expect as many as up to 15 a year on average worst case (the maximum value of the climate models). Gatwick is also expected to experience an average of 52 more hot days a year (69 hot days compared the 17 hot days per year for the baseline) but this could reach as high as 93 per year. For projected dry spells, 10 days or more

with no precipitation, Gatwick is projected to average 5-7 per year (model minimum and mean respectively) and average an increase of 1 day year, to 3 days a year, of heavy rainfall (when precipitation is greater than 25 mm per day) up to 5 days a year (model maximum). Relative humidity in winter shows little to no change compared to the baseline is high in winter at 85% and is decreasing by 8% in the summer to 69% (Table 15.5.8).

Table 15.5.8: UKCP18 Projections for Future Extreme Weather Events for the Gatwick Area for the 2060s

Parameter	2060s (2050-2079)		
	RCP8.5 Min	RCP8.5 Mean	RCP8.5 Max
Number of frost days (daily minimum temperature equal or lower than 0°C)	22	25	31
Heatwaves (two days with maximum temperature higher than 29°C and minimum temperature higher than 15°C)	3	8	15
Number of hot days (daily maximum temperature higher than 25°C)	43	69	93
Dry spells (10 days or more with no precipitation)	5	7	8
Number of days per year when precipitation is greater than 25 mm per day (Met Office definition of 'heavy rain')	2	3	5
Relative humidity winter (%)	84	85	86
Relative humidity summer (%)	65	69	72

RCP8.5 Min, Mean and Max refer to the model ensemble minimum, mean and maximum values across the 12 models in the 12km Regional UCKP18 data.

15.5.33 Changes in future seasonal values for three climate variables; daily maximum temperature at 1.5m, daily maximum precipitation and 5-day accumulated precipitation were obtained from the PPCE data set on a 25km x 25km grid for the RP8.5 scenario. The nearest grid cell to Gatwick selected and is shown in **ES Figure 15.5.2** (Doc Ref. 5.2).

15.5.34 Table 15.5.9 shows the future values for seasonal averages of daily maximum temperature, daily maximum precipitation, and 5-day accumulated precipitation under a high emissions scenario (RCP8.5) for the end of the century (2050-2079). The data reflects the 95th percentile and 5th percentile for the 1 in 100-year return period. For more detail on the PPCE data and sensitivity analysis of climate extremes see **ES Appendix 15.5.1: Sensitivity Analysis – Climate Extremes** (Doc Ref 5.3).

Table 15.5.9: Future (2050-2079) seasonal average PPCE data

Parameter	2050-2079 (RCP 8.5)
Daily maximum air temperature at 1.5m (°C) (95th Percentile)	
Autumn	36.6
Winter	21.6
Spring	36.0
Summer	43.4
1 day maximum precipitation (mm) (95th Percentile)	
Autumn	106.6
Winter	79.8
Spring	67.0
Summer	80.1
Driest 1 day maximum precipitation (mm) (5th percentile)	
Autumn	54.3
Winter	43.6
Spring	32.8
Summer	38.8
5 day maximum precipitation (mm) (95th percentile)	
Autumn	191.7
Winter	109.4
Spring	110.2
Summer	106.8
Driest 5 day maximum precipitation (mm) (5th Percentile)	
Autumn	114.2
Winter	83.7
Spring	65.2
Summer	62.1

Urban Heat Island effect

15.5.35 It is anticipated that climate change would contribute to a slight increase in the UHI effect at Gatwick. The assessment of this effect used the latest UKCP18 from the Met Office (2018a). The Probabilistic Projections were used, which are based on a 25km dataset. For these projections, one grid square encompassed both Gatwick and Charlwood. Using this dataset, it was difficult to differentiate between Charlwood and Gatwick. Therefore, this assessment was indicative of potential future changes in UHI. Additional information can be found in **ES Appendix 15.5.2: Urban Heat Island Assessment** (Doc Ref. 5.3).

15.5.36 Temperatures are projected to increase across all three sites included within this assessment (see Table 15.5.10).

Table 15.5.10: Temperature anomalies (from 1981-2010 baseline) under RCP8.5

Site	Summer Average Temperature (°C)		Summer Maximum Temperature (°C)		Summer Minimum Temperature (°C)	
	2020-2049	2050-2079	2020-2049	2050-2079	2020-2049	2050-2079
Gatwick Airport and Charlwood	1.5 (2.4-0.5)	3.5 (5.3-1.7)	1.6 (2.9-0.3)	3.8 (6.2-1.6)	1.3 (2.1–0.5)	3.1 (4.7-1.6)
London City Airport	1.4 (2.3-0.5)	3.4 (5.2-1.6)	1.6 (2.8-0.3)	3.8 (6.1-1.5)	1.2 (2.0-0.5)	3.0 (4.6-1.5)

The 50th percentile is presented with the 10th-90th percentiles in brackets.

15.5.37 The developed site would have increased impervious surface cover and buildings due to the extension of the taxiways, hotels and car parks, among other features. Impervious surface cover such as this contributes to the UHI effect. Therefore, these features would increase the UHI effects at the Project site, local to the airport only. This indicates that, due to the increased impervious surface cover and building, the Project may exacerbate the anticipated slight increase in the UHI from climate change at Gatwick itself, local to the airport and not the wider area.

15.6. Assumptions and Limitations of the Assessment

15.6.1 All climate change projections are subject to uncertainties, due to the complexity of the climate system, natural climate variability, uncertainty over future GHG emission levels and modelling uncertainties.

15.6.2 In order to address uncertainty in model projections, UKCP18 (Met Office, 2018a) provides probabilistic projections for some climate variables, that is, likelihoods are assigned to different levels of change. The existence of probabilistic projections and available information can be used to provide an estimate of the level of confidence for the magnitude and direction of changes in climate. Probabilistic projections, however, are not available for all relevant climate variables, particularly those relating to extreme climate events. Information regarding extremes can be obtained from a set of Regional Climate Model projections, although this data only goes up to 2079.

15.6.3 Information on climate change effects on fog is not currently available in UKCP18 (Met Office, 2018a). The information available from UKCP09 (Met Office, 2009) has therefore been used in this assessment.

15.6.4 Assessments made in relation to ‘consequence’ and ‘likelihood’ relied on professional judgement and evidence gathered through other environmental discipline assessments within the ES.

15.6.5 All existing assets that are not being modified as part of the Project are assumed to be maintained in line with Gatwick’s existing CCAP (GAL, 2021a) and therefore are not assessed

here. This ES chapter reports on the assessment of future impacts for modified assets and new assets constructed as part of the Project only.

15.6.6 A commitment to the continuation of the Gatwick Airside AWP (GAL, 2021b) and its adherence is relied upon for the climate change assessment during operation. Gatwick Airport is required to have an AWP, as per UK Civil Aviation Authority regulations. This Plan is prepared to preserve passenger, operational safety and business continuity. For the purposes of the CCR assessment during the operational period, it has been assumed that GAL would commit to continuing its Gatwick Airside AWP (GAL, 2021b) and enhance it as needed to consider a changing climate, following Eurocode good practice for both AWPs (Eurocontrol, 2021a) and managing climate risks (Eurocontrol, 2021b).

15.6.7 Flood risk is addressed through the **ES Appendix 11.9.6: Flood Risk Assessment** (Doc Ref. 5.3) and there is commitment to the Flood Resilience Statement (**ES Appendix 11.9.6 Flood Risk Assessment Annex 6** (Doc Ref. 5.3)).

15.6.8 With respect to embedded mitigation from existing plans and procedures that the CCR and ICCI assessments rely on for the Project, GAL commits to the continuation of and adherence to:

- assets designed based on the latest standards and specification that take future climate change into account;
- the latest Airside Operations AWP including existing operational procedures in place to ensure health and wellbeing of passengers and staff during cold weather (not just hot weather);
- measures relating to allowances in maximum take-off weight, maximum plane operating temperatures and take-off in hot days are managed by flight operation procedures;
- infrastructure assets designed to the climatic conditions experienced at the end of their life cycle using appropriate future climate change projections and allowances (as advised by regulators).

15.7. Key Aspects of the Project

15.7.1 The assessments have been based on the description of the Project within **ES Chapter 5: Project Description** (Doc Ref. 5.1).

15.7.2 Table 15.7.1 below identifies the maximum design scenarios where relevant to this assessment. Where options exist, the maximum design scenario selected is the one having the potential to result in the greatest effect on an identified receptor or receptor group. Effects of greater adverse significance are not predicted to arise should any other option identified in **ES Chapter 5: Project Description** (Doc Ref. 5.1) be taken forward.

15.7.3 The RCP8.5 UKCP18 emissions scenario (Met Office, 2018a) (the 'high' emissions scenario) has been used to assess climate change effects, as it represents the maximum level of climate change in UKCP18.

Table 15.7.1: Maximum Design Scenarios

Potential Impact	Maximum Design Scenario	Justification
Construction Period for ICCI and CCR: 2030s		

Potential Impact	Maximum Design Scenario	Justification
Climate change impacts to all receptors and asset groups identified by the topic chapters and set out in **ES Chapter 5: Project Description** (Doc Ref. 5.1) respectively.	Construction activities are anticipated to be sequenced over a period of from 2024-2035, and therefore the 2020-2049 time period for a RCP8.5 scenario has been used.	The assessment year used for each receptor or asset group represents the maximum level of climate change in UKCP18 for this time period.
Operation Period for ICCI and CCR: 2060s		
Climate change impacts to all receptors identified by the topic chapters and all asset groups identified by the **ES Chapter 5: Project Description** (Doc Ref. 5.1)	For the receptors identified by the topic chapters and all asset groups identified in the Project Description, the climate change projections for the 2050-2079 ('2060s') Future Climate Scenario have been used to represent climate changes up to a future Design Year of 2080.	For the ICCI assessment, climate change projections for this time period were used to represent the maximum level of climate change (using UKCP18 projections) for all topic receptors. For the CCR assessment, climate change projections for this time period were used in view of the requirement of the NN NPS to consider climate changes out to 2080 where infrastructure has a design life of 60 years or more and has safety critical elements (both conditions have been assumed to apply). It was not possible to consider climate projections beyond 2079 because the projected extreme weather dataset outlined in UKCP18 only extends to 2079 and therefore datasets is considered the most appropriate for assessing CCR issues.

15.8. Climate Change Resilience Assessment

Methodology

15.8.1 This CCR assessment considers the resilience of the Project to the physical impacts of climate change.

15.8.2 The IEMA guidance (IEMA, 2020) defines CCR as the *'ability to respond to changes in climate. If a receptor or project has good climate change resilience, it is able to respond to the changes in climate in a way that ensures it retains much of its original function and form. A receptor or project that has poor climate change resilience will lose much of its original function or form as the climate changes'*.

15.8.3 The CCR assessment differs from many other EIA topics in that it considers how the resilience of a development may be affected by an external factor (climate change) not how environmental receptors may be affected by a development's impacts. Consequentially, the CCR impacts cannot be assigned significance with respect to the severity of impacts in the same way as for the other environmental topics. Instead, a risk-analysis based approach was used for the CCR assessment.

15.8.4 The methodology for the CCR risk assessment was as follows (see Diagram 15.8.1):

- identify the receptors (eg assets and asset groups) included within the Project that would be potentially at risk from climate change impacts;
- identify climate change hazards (eg floods, heatwaves, droughts) that may affect the geographical location of the Project;
- determine the likelihood of climate change hazards (eg floods, heatwaves, droughts) occurring in the future, based on the future climate change projections;
- determine the likelihood of the hazard having a climate change impact on the receptors, noting that:
  - the likelihood of each impact was determined based on the definitions in Table 15.8.1;
  - the assessment was qualitative using expert judgement and in discussion with the design team, with the exception of flood risk for which quantitative assessments have been carried out; and
  - embedded mitigation and enhancement measures have been taken into account in the assignment of a likelihood category
- determine the consequence of each impact based on the definitions in Table 15.8.2; and

determine the risk level based on a combination of likelihood and consequence based on the risk matrix given in Table 15.8.3.

Assessment Criteria and Assignment of Significance

15.8.5 While there were no specific significance criteria for this assessment, a framework was developed which combined the outcomes from the likelihood assessment with the potential consequence to determine the level of effect (risk) (see Table 15.8.3). Risk was determined according to a five-point scale: very low, low, medium, high or very high. Any impacts determined to be high or very high risk were deemed significant and identified as requiring mitigation, as per climate risk and

resilience assessment good practice (which differs to other EIA topic assessments and chapters). For the purposes of the CCR, the 2060s Future Climate Scenario (paragraph 15.5.2) was used.

15.8.6 The risk matrix used within this ES chapter matches that included within the latest ARP3 document for Gatwick (GAL, 2021a).

Diagram 15.8.1: Methodology for the CCR assessment

Table 15.8.1: Criteria to assess likelihood of climate change impact

Level of Likelihood	Definition of Likelihood
Very unlikely	It is highly improbable that the impact would occur during the construction period or operation period[7] of the Project.
Unlikely	Impact is not expected to occur during the construction period or operation period of the Project.
As likely as not	Impact may occur during the construction period or operation period of the Project.
Likely	Impact is expected to occur during the construction period or the lifespan of the Project.
Very likely	It is highly probable that the impact would occur during the construction period or the lifetime of the Project.

Table 15.8.2: Criteria used to assess consequence of a climate change impact

Consequence Rating	Disruption	Public perception	Financial consequences to owners GAL and operators	Safety	Damage
Minimal	Minor service disruption within a single day (<30 mins).	Short-term adverse local stakeholder reaction.	Negligible financial loss.	Minor harm or near miss – no adverse human health effects or complaints.	No damage to assets.
Minor	Minor service disruption for multiple days or delays up to two hours on a single day.	Adverse local media reports over sustained period; localised stakeholder concern.	Additional operational costs. Minor financial loss.	Lost time injury or medical treatment, short-term impact on persons affected.	No permanent damage. Some restoration work required.

[7] The CCR assessment goes out to 2079 as the 2060s (2050-2079) time frame is considered.

Consequence Rating	Disruption	Public perception	Financial consequences to owners GAL and operators	Safety	Damage
Moderate	Service delays of up to two hours for multiple days or major delays (>two hours) on a single day.	Significant local and/or regional reports including social media. National media interest creating public concern.	Moderate financial loss.	Long term injury or illness, prolonged hospitalisation or inability to work.	Widespread damage and loss of service. Damage recoverable by maintenance and minor repair. Partial loss of local infrastructure.
Major	Service closed for one day or major delays for multiple days.	Negative national reporting and public disputes with key stakeholders, utility companies or other governmental agencies such as the EA.	Major financial loss.	Single fatality/multiple long-term injuries – emergency response.	Extensive damage requiring extensive repair.
Catastrophic	Service closed for multiple days.	Extensive and prolonged negative reporting nationally and/or public disputes with key stakeholders.	Significantly high financial loss.	Multiple fatalities – emergency response.	Permanent damage and/or loss of service. Retreat and translocation of development

Table 15.8.3: Risk levels as a function of combined likelihood and consequence

Likelihood	Consequence				
	Minimal	Minor	Moderate	Major	Catastrophic
Very unlikely	Very low	Very low	Low	Low	Medium
Unlikely	Very low	Very low	Low	Medium	Medium
As likely as not	Low	Low	Medium	High*	High*
Likely	Low	Medium	Medium	High*	Very high*
Very likely	Medium	Medium	High*	Very high*	Very high*

* High and very high risk levels deemed significant and warrant further mitigation.

Mitigation and Enhancement Measures Adopted as Part of the Project

15.8.7 The adaptive capacity of the Project has been considered, based on the resilience inherent in embedded mitigation and the capacity of the Project to be retrofitted to be even more resilient in the future. Mitigation has been considered in the future against the timescale of the Project and when mitigation might be most usefully implemented. In all but exceptional circumstances (e.g. when having to design in fixed elements of a project that cause significant negative effects on current and future baseline conditions), it would not be appropriate to propose that costly and permanent mitigation be put in place if it is not going to be required for another 50 years (IEMA, 2020).

15.8.8 Gatwick has policies and procedures in place to minimise the impacts of extreme weather events. Embedded mitigation to supplement existing practices is set out in

15.8.9 . These existing practices are used in the CCR risk assessment, ie existing practices are assumed to be extended to (or adopted by) the new Project with commitment of and adherence to the latest plans and procedures secured for the DCO.

15.8.10 No enhancement measures have been identified at this ES stage; but would be reviewed at the next detailed design stage (to follow DCO consent).

Table 15.8.4: Mitigation Measures for Climate Change Resilience Assessment

Measures Adopted as Part of the Project	Justification	How secured
Embedded Mitigation		
Outline Climate Resilience Design Principles and example measures for heating and cooling in the **Design and Access Statement** (Doc Ref. 7.3), supported by the **ES Appendix 5.4.2: Carbon Action Plan** (Doc Ref. 5.3) which commits to net zero by 2030 (for scope 1 and 2 emissions)	The DAS secures, and the Carbon Action Plan directly supports, resilience through reducing reliance on, and requiring additional capacity during prolonged warmer/colder seasons and extreme events, on the energy grid; increasing overall energy resilience by requiring low carbon heating, cooling and energy use.	Design Principles – **Design and Access Statement** (Doc Ref. 7.3) **ES Appendix 5.4.2: Carbon Action Plan** (Doc Ref. 5.3)
Gatwick Airside Operations AWP: includes all airside operations areas and how they can sustain stable operations in the event of an adverse weather event.	This plan supports resilience by setting out processes and procedures for different extreme weather events.	Continuation, adherence and enhancement for climate change, to the latest Gatwick Airside Operations AWP as required by UK CAA regulation.
Adverse weather measures during construction in the CoCP.	The CoCP sets out best practice construction methods including adverse weather measures in Construction to ensure that there are plans in place (which include all airside operations areas) about how GAL can sustain stable construction in the event of an adverse weather event including a processes and procedures for different extreme weather events during the construction period.	**ES Appendix 5.3.2: Code of Construction Practice** (Doc Ref. 5.3)

Measures Adopted as Part of the Project	Justification	How secured
Outline Landscape and Ecology Management Plan (oLEMP)	This outlines the combined strategies for landscape and ecology and incorporates several mitigation measures. It demonstrates the elements and landscape zones that would be created as part of the Project, in addition to actions for their ongoing maintenance and management. Secured under the oLEMP.	**ES Appendix 8.8.1: Outline Landscape and Ecology Management Plan** (Doc Ref. 5.3)
Flood Resilience Statement (as part of the FRA) Surface Access Drainage Strategy as relevant to the Water Environment	The Flood Resilience Statement and relevant aspects of the Drainage Strategy details the measures to ensure there is no adverse impact on flood risk as a result of the Project, this is secured as part of the Project design.	Flood Resilience Statement – **ES Appendix 11.9.6: Flood Risk Assessment – Annex 6** (Doc Ref. 5.3) Surface Access Drainage Strategy – **ES Appendix 11.9.6: Flood Risk Assessment – Annex 2** (Doc Ref. 5.3)
Outline Climate Resilience Design Principles and example measures for Water Stress in the Water Management Plan	The Water Management Plan climate resilience design principles and example measures directly supports resilience through reducing mains water use and demand.	Design Principles – **Design and Access Statement** (Doc Ref. 7.3) **ES Appendix 5.3.2: CoCP Annex 1 – Water Management Plan** (Doc Ref. 5.3)

Assessment of Effects

15.8.11 The full CCR assessment for the construction and operational periods is presented in **ES Appendix 15.8.1 Climate Change Resilience Assessment** (Doc Ref 5.3). A summary of the CCR (risk based) assessment is set out below.

Construction Period: 2030s

15.8.12 The risks identified in the CCR assessment are presented in Table 15.8.5 below. No Very High or High risks (considered significant) were identified in the assessment., therefore no significant effects are expected.

Table 15.8.5: CCR Assessment for the Construction Period

Risk ID	Climate Change Hazard	Trend or Likelihood of Climate Hazard occurring[8]	Asset Group	Climate Change Impact	Risk
1	Increased number of extremely hot days	Increasing trend Likely	Temporary buildings for construction workers and site offices	Increased risk of overheating in temporary building accommodation for construction workers likely to have negative impacts on working conditions during construction of the Project.	Medium
2	Climate changes in 2024-2047 time period and increased probability of extreme weather events	Increasing trend Likely	Construction processes	Disruption or hinderance of construction processes.	Medium

Further Mitigation

15.8.13 No high or very high risks (considered significant) during construction were identified in the CCR assessment. Therefore, no further mitigation is required. Whilst not considered necessary to avoid significant effects, additional measures may be implemented following scheme refinements during detailed design stage which would further reduce the risk of any significant effect.

Future Monitoring

15.8.14 No future monitoring is proposed with regard to CCR during this construction period of the Project as the existing and embedded mitigation identified are considered to be sufficient.

Operation Period: 2060s

15.8.15 The CCR assessment for the operational period is presented in Table 15.8.6. The risk classification (column 4 of the table below) is a function of likelihood and consequence as illustrated in Table 15.8.3.

[8] Based on analysis of UK Climate Projections (UKCP18) data.

Table 15.8.6: CCR (risk based) Assessment for the Operational Period

Risk ID	Climate Change Hazard	Trend or Likelihood of Climate Hazard occurring[9]	Asset Group	Climate Change Impact	Risk
3	Increased number of extremely hot days	Increasing trend Very likely	Airport operation	Overheating in terminal buildings, hotels, and other buildings including in relation to the replacement Central Area Recycling Enclosure (CARE) facility and new waste water treatment works (WWTW), leading to thermal discomfort and heat stress for passengers and staff during the operation of the airport that could lead to negative health implications, and negative customer experience.	Medium
4			Airport operation/ infrastructure	In hot weather, air is less dense which means there are less molecules for the wings of the plane to push down and produce lift. If a plane is taking off in such conditions, then it must travel much faster before it is able to generate enough thrust to take off.	Medium
5				Reliability of journeys may reduce at high temperatures due to potential deformation of asphalt surface in long periods of hot, sunny conditions causing delays.	Medium
6			Electronic equipment	Sensitive electronic equipment and mechanical operating mechanisms may fail to operate correctly due to high temperatures.	Medium
7		Increasing trend Likely	Flights	Flashpoint of aviation fuel may be exceeded on hot days, leading to delays in re-fuelling procedures.	Low
8				Possible increase in occurrence of days outside the acceptable range of temperatures affecting aircraft and their utilisation	Medium

[9] Based on analysis of UK Climate Projections (UKCP18) data.

Risk ID	Climate Change Hazard	Trend or Likelihood of Climate Hazard occurring[9]	Asset Group	Climate Change Impact	Risk
				schedule, due to air density changes affecting maximum take-off weight capacity.	
9	Extreme cold weather	Decreasing trend Very unlikely	Electronic equipment	Sensitive electronic equipment and mechanical operating mechanisms may fail to operate correctly due to low temperatures or freezing.	Medium
10			Airport infrastructure	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.	Medium
11			Airport operation	Possible negative health implications for passengers and staff, and disruption to service operation.	Low
12			Airport infrastructure	Periods of extreme cold could affect heating, ventilation and air conditioning (HVAC) that is undersized and cannot deliver comfort temperatures, and also that the plant may fail/break if not selected and constructed to withstand extreme cold.	Very low
13	Increased frequency of flooding from river, surface and groundwater sources	Increasing trend Likely	Airport infrastructure	Flooding of infrastructure during operation: inundation of airfield, airport building basements and sub-structures, utility cables/tunnels.	Medium
14				Flooding of road infrastructure connecting to the airport during operation: inundation of access roads and railways. Effects of infrastructure interdependencies.	Medium
15			Airport operation	Flooding of electrical equipment and mechanical operating mechanisms.	Medium

Risk ID	Climate Change Hazard	Trend or Likelihood of Climate Hazard occurring[9]	Asset Group	Climate Change Impact	Risk
16	Increased risk of drought	Increasing trend Likely	Landscaping	Increased heat and drought stress to plants/landscaped areas.	Medium
17			Airport operation	Increased water stress for new buildings (hotel and office space, including the CARE facility and new WWTW).	Medium
18	Extreme wind speeds	Possible – low certainty	Airport infrastructure	Possible debris on runways and other airport infrastructure causing delays (foreign object debris).	Medium
19				Vegetation fall due to strong winds leading to road and rail disruption.	Medium
20				Failure or damage to parts of structure or infrastructure as a result of changes in strong winds and gustiness.	Medium
21	Increased risk of lightning strikes	Possible – low certainty	Flights	Aircrafts not permitted to take off or land causing delays.	Medium
22			Airport infrastructure	Indirect and direct damage to buildings, infrastructure, aircraft, equipment from lightning strikes.	Low
23			Flights	Suspension of activities on the ramp by ground handling agents, delaying the service and turnaround times for aircraft and stressing terminal/gatehouses.	Low
24	Increased number of extremely hot days	Increasing trend Likely	Airport infrastructure and operations, landscaping and electrical equipment	The slight night-time UHI identified at Gatwick (see **ES Appendix 15.5.2 Urban Heat Island Assessment** (Doc Ref. 5.3)) may be exacerbated by climate change. This may contribute to damage to infrastructure (eg deformation of asphalt), contribute to increased drought/heat stress for plants, impact the ability of electronic equipment to operate effectively due to overheating and impact those working outside.	Medium

Further Mitigation

15.8.16 No high or very high risks (considered significant) during operation were identified in the CCR assessment. Therefore, no further mitigation is required. Whilst not considered necessary to avoid significant effects, additional measures may be implemented following scheme refinements during detailed design stage which would further reduce the risk of any significant effect.

Future Monitoring

15.8.17 As a responsible operator, and in compliance with the evolving legislative landscape, GAL has procedures to check the efficacy of embedded mitigation measures and keep them under review on account of regulator change, other circumstances change or the prevailing climate changes; to preserve passenger and operational safety and business continuity. All risks, especially the medium risks (not significant) (see **ES Appendix 15.8.1 CCR Assessment** for more detail) to ensure they do not move to the high or very high rating, need regular review. During operation this can be formalised and aligned with the GAL's Task Force for Climate-Related Disclosures (TCFD) mandatory reporting (latest example in GAL, 2023) and GAL's 5-year review cycle for the Climate Adaptation Risk Assessment (GAL, 2021), reporting to the Government under the ARP as part of the 2008 Climate Change Act. Although currently voluntary, all major airport and infrastructure operators currently report under the ARP and this reporting may become mandatory in the future.

15.9. In-combination Climate Change Impacts Assessment

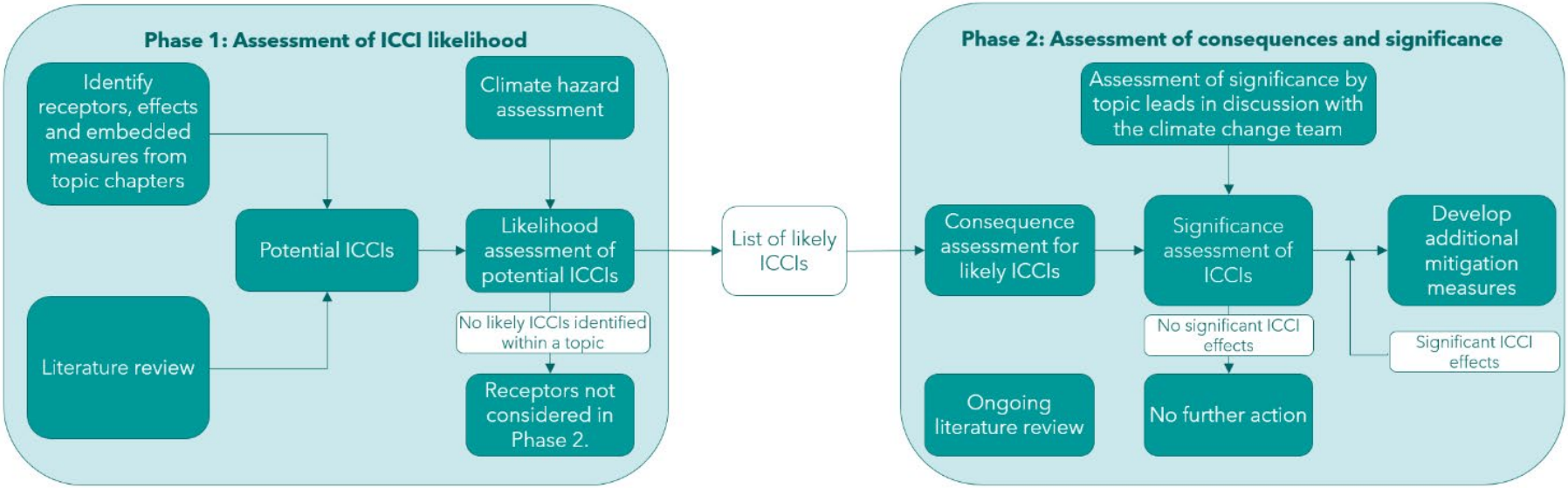
Methodology

15.9.1 The ICCI assessment assesses the extent to which climate change exacerbates a potential effect of the Project on an environmental receptor listed in Table 4.4.1 in **ES Appendix 15.4.1: Climate Change Resilience Definitions** (Doc Ref. 5.3). The full ICCI assessment is set out in **ES Appendix 15.9.1: In-combination Climate Change Impacts Assessment** (Doc Ref. 5.3) and a summary is provided below.

15.9.2 The ICCI assessment methodology was developed in line with the IEMA – 'EIA Guide to CCR and Adaptation' (IEMA, 2020).

15.9.3 Key terminology used within the ICCI assessment is presented in **ES Appendix 15.4.1: Climate Change Resilience Definitions** (Doc Ref. 5.3). The ICCI assessment followed the same approach to assessing impacts and determining significance as for each of the ES topics, but with the added consideration of future climate change projections. The methodology for the ICCI assessment is described in Diagram 15.9.1.

Diagram 15.9.1: Methodology for ICCI Assessment



Phase 1 Assessment of In-combination Climate Change Impact Likelihood

15.9.4 Phase 1 considered the effects already identified by ES topics based upon their own impact assessment methodologies, and aimed to screen out any ICCIs that were considered unlikely to occur, ie climate change hazards that do not influence the impact identified by the ES topic, and therefore do not require further assessment.

15.9.5 Phase 1 also identified any embedded environmental measures and further mitigation identified for the ES topics.

15.9.6 A list of potential ICCIs was collated based on:

- the initial assessment of the other ES topic chapters based on their own assessment methodologies; and
- a literature review of recent guidance, science and policy relating to climate change impacts on the relevant receptors.

15.9.7 The likelihood of each potential ICCI occurring was assessed using expert judgement based on two factors, as follows:

- the likelihood of the climate impact occurring, based on the climate hazard assessment; and
- the likelihood of the climate impact changing an effect already identified by another ES topic. This assessment was based on the literature review and expert judgement. In assessing likelihood, the embedded and further mitigation measures were also considered.

15.9.8 Owing to the uncertainties involved, the potential ICCIs were assessed to be either 'likely' or 'unlikely'. Where the ICCI was deemed 'unlikely', either due to the climate impact being unlikely to occur or there being a weak link between the climate impact and the effect on a receptor, it was not taken forward to Phase 2.

Assessment Criteria and Assignment of Significance

Phase 2 Assessment of Consequence and Significance

15.9.9 Phase 2 assessed the consequence of the likely ICCIs identified in Phase 1, thus enabling a determination of significance for each.

15.9.10 The assessment of significance was completed by the climate change specialist and environmental specialists from the relevant topics working together to provide a qualitative assessment of consequence and therefore significance of the ICCI.

15.9.11 The ES topics use different criteria for determining significance, so there is no single approach to determining the significance of an ICCI. The effect of an ICCI has been considered significant if:

- an effect which was previously not significant becomes significant in terms of the significance criteria used by the ES topic owing to the influence of climate change (eg an increase in consequence of effect or an increase in scale of change); and/or
- an existing significant effect is exacerbated in terms of the significance criteria used by the ES topic owing to the influence of climate change (eg a further increase in the consequence of effect or a further increase in scale of change).

15.9.12 If an effect was not previously significant and any exacerbation by climate change does not change this, the ICCI effect is not significant.

15.9.13 The spatial extent, duration and time horizon of the climate change impact were considered when determining whether the effect of the Project on the environmental receptor in question would be greater because of the impact of climate change. Embedded and further mitigation measures have been included within the assessments of significance.

15.9.14 The exception to this approach is the assessment for flood risk and drainage design. A separate FRA (see **ES Appendix 11.9.6: Flood Risk Assessment** (Doc Ref. 5.3)) has been carried out, which is quantitative and followed current EA guidance (2022) on climate change allowances for all forms of flood risk. A relevant extract of Gatwick's Drainage Strategy (GAL, in press) has been included in Chapter 11: Water Environment. This informed the ICCI assessment that was completed for the potential effects identified in **ES Chapter 11: Water Environment** (Doc Ref. 5.1).

Mitigation, Monitoring and Enhancement Measures Adopted as Part of the Project

15.9.15 Mitigation and enhancement measures identified by other environmental topics and how they influenced the ICCI assessment are presented in Table 15.9.1 below.

Table 15.9.1: Mitigation, monitoring and enhancement measures for ICCI assessment

Measures Adopted as Part of the Project	Reason	How Secured
Embedded Mitigation – Construction Period		
Measures contained within the CoCP	This document details the measures that would be adopted during construction. It sets out best practice construction methods to mitigate potential in-combination climate change impacts, for example, from climate change on groundwater receptors (**ES Chapter 10: Geology and Ground Conditions** (Doc Ref. 5.1)) and on leaving the waterlogged channel in place and spanning over it when excavating for water storage (**ES Chapter 7: Historic Environment** (Doc Ref. 5.1)).	**ES Appendix 5.3.2: Code of Construction Practice** (Doc Ref. 5.3)
Vegetation retention and management	To ensure green infrastructure assets are retained wherever possible, and their ongoing management is maintained so the impacts on the character of surrounding landscapes and townscapes are minimised.	**ES Appendix 5.3.2: Code of Construction Practice** (Doc Ref. 5.3)
Planting woodland, tree, scrub, shrub, wetland, amenity and grassland planting	Planting proposals ensure a high-quality environment is created. These proposals include consideration of climate change as the plant species chosen would be resilient to all extreme weather conditions and climate change. This includes drought resistant species in the planting options to increase the resilience of plants to future drought conditions. This would also benefit several environmental topics; **ES Chapter 7: Historic Environment** (Doc Ref. 5.1), **ES Chapter 8: Landscape, Townscape and Visual Resources** (Doc Ref. 5.1), **ES Chapter 9: Ecology and Nature Conservation** (Doc Ref. 5.1), **ES Chapter 17: Socioeconomics** (Doc Ref. 5.1).	**ES Appendix 8.8.1: Outline Landscape and Ecology Management Plan** (Doc. Ref. 5.3)
Landscape resilience	To build long-term climate resilient mitigation into the landscape surrounding Gatwick.	**ES Appendix 8.8.1: Outline Landscape and Ecology Management Plan** (Doc. Ref. 5.3)

Measures Adopted as Part of the Project	Reason	How Secured
Creation of new high value habitats comprising wet and dry neutral grasslands along the new channel of the River Mole and within the Museum Field. Also, creation of new habitat within the mitigation area in the western part of the Project site.	To provide new habitats for fauna displaced during the diversion of the River Mole, enhancing existing habitats and increasing the resilience of flora subject to increased drought conditions in future.	**ES Appendix 8.8.1: Outline Landscape and Ecology Management Plan** (Doc. Ref. 5.3)
Implementation of measures to prevent and control spillage of oil, chemicals and other potentially harmful liquids. This would ensure appropriate storage and handling of materials and products in accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001	The implementation of measures to ensure appropriate storage and handling of materials and products that reduce the impact of accidental spillages and potential impacts from simultaneous flooding events. This is captured in the **ES Appendix 5.3.2 Code of Construction Practice** (Doc Ref. 5.3).	**ES Appendix 5.3.2: Code of Construction Practice** (Doc. Ref. 5.3)
Realignment of the River Mole	Natural plan form to improve flow regime increasing the existing capacity of the river (**ES Chapter 11: Water Environment** (Doc Ref. 5.1)). This mitigation would also increase the resilience of the surrounding area to changing climate and provide additional habitats (**ES Chapter 9: Ecology and Nature Conservation** (Doc Ref. 5.1)).	**ES Appendix 8.8.1: Outline Landscape and Ecology Management Plan** (Doc. Ref. 5.3)
Provision of compensatory flood storage areas at Museum Field and existing Car Park X.	To replace lost floodplain storage during construction and reduce flood risk in future.	Flood Compensation Areas Delivery Plan – DCO Requirement **ES Appendix 8.8.1: Outline Landscape and Ecology Management Plan** (Doc. Ref. 5.3) Flood risk activity permit

Measures Adopted as Part of the Project	Reason	How Secured
Provision of new airfield syphons and new noise bund syphons	Two airfield syphon connections are proposed to retain floodplain connection on both sides of the proposed taxiways. Six syphons beneath the noise bund would maintain floodplain connectivity.	Design Principles – **Design and Access Statement** (Doc Ref. 7.3)
Additional attenuation storage within the existing airfield surface water drainage network	New surface water attenuation in several areas. In the southwest zone, an underground attenuation with a storage capacity of 2,800 m^3. New attenuation storage is also proposed beneath Car Park Y to increase the capacity of the surface water drainage network. This would have a capacity of 32,000m^3. Additional storage is proposed within the existing airfield surface water drainage network to store and attenuate additional runoff from the increase in impermeable area due to the Project.	Design Principles – **Design and Access Statement** (Doc Ref. 7.3)
Pumping station	A new pumping station in the southwest zone is proposed. This would be sized based on the final design of the Project to ensure runoff from new impermeable area from the runway and taxiways within the existing Pond M catchment is controlled to greenfield runoff rates.	Design Principles – **Design and Access Statement** (Doc Ref. 7.3)
Surface Access Highways Improvements Drainage Design	As part of the proposed surface access (highways) improvements, it is proposed that a drainage network is installed, consisting of carrier drains, filter drains, ditches, swales and attenuation ponds, along with flow control arrangements to limit discharges to watercourses.	Surface Access Drainage Strategy – **ES Appendix 11.9.6: Flood Risk Assessment – Annex 2** (Doc Ref. 5.3)
Outline Construction Traffic Management Plan	To minimise any negative environmental and community impacts including the impacts of extreme weather events.	**ES Appendix 5.3.2: CoCP Annex 3 - Outline Construction Traffic Management Plan** (Doc. Ref. 5.3)

Measures Adopted as Part of the Project	Reason	How Secured
Noise Insulation Scheme	This voluntary scheme by Gatwick for offsite residential buildings or dwellings that qualify would offer acoustic and ventilation measures to reduce noise impacts. It would also reduce overheating risk to households that sign up to the scheme, as the ventilators allow residents to keep windows closed. The scheme is voluntary, and it may be that climate change would increase uptake, allowing for greater mitigation of noise impacts. See **ES Chapter 14: Noise and Vibration** (Doc Ref. 5.1), Paragraph 14.10.4 for further details.	**ES Appendix 14.9.10: Noise Insulation Scheme** (Doc Ref. 5.3)
Soil Management Strategy	To ensure no additional negative impacts from climate change, by conserving soil resources, avoiding damage to soil structures, maintaining soil drainage and reinstating soil profiles during construction.	**ES Appendix 5.3.2: CoCP Annex 4 – Soil Management Strategy** (Doc. Ref. 5.3)
Provision of replacement existing public open space	The newly designed public space is expected to enhance existing conditions; thus reducing negative effects of extreme events on public behaviour and patterns of use (**ES Chapter 17: Socio-economics**, **ES Chapter 19: and Agricultural Land Use and Recreation** (Doc Ref. 5.1)).	Replacement open space implementation plan – DCO Article **ES Chapter 17: Socioeconomics** (Doc Ref. 5.1) **ES Chapter 19: Agricultural Land Use and Recreation** (Doc Ref. 5.1)
Managing palaeo-channels	The process for managing palaeo-channels that are identified during works detailed in the CoCP (for more detail see **ES Chapter 7 Historic Environment** (Doc Ref. 5.1)).	**ES Appendix 5.3.2: Code of Construction Practice** (Doc Ref. 5.3)

Measures Adopted as Part of the Project	Reason	How Secured
Development of a new water treatment works	The new WTW would increase the capacity of the long-term storage lagoons.	**ES Appendix 11.9.6: Flood Risk Assessment** (Doc Ref. 5.3) Flood Resilience Statement – **ES Appendix 11.9.6: Flood Risk Assessment Annex 6** (Doc Ref. 5.3)
Public Rights of Way Management Strategy	To reduce erosion from overuse and extreme events to public paths, this strategy would include measures to be followed to address path diversions during construction.	**ES Appendix 19.8.2: Public Right of Way Strategy** (Doc Ref. 5.3)
Management System from the Flood Resilience Statement (as part of FRA) Surface Access Drainage Strategy relevant to the Water Environment	See **ES Appendix 11.9.6 Flood Risk Assessment** (Doc Ref. 5.3). The Management System and relevant aspects of the Drainage Strategy both reduce the risks of flooding and the extent of the impacts of flooding.	**ES Appendix 11.9.6: Flood Risk Assessment** (Doc Ref. 5.3) Flood Resilience Statement – **ES Appendix 11.9.6: Flood Risk Assessment Annex 6** (Doc Ref. 5.3) Surface Access Drainage Strategy – **ES Appendix 11.9.6: Flood Risk Assessment – Annex 2** (Doc Ref. 5.3)

Measures Adopted as Part of the Project	Reason	How Secured
Dust Management Measures	This plan should include measures to control dust and other emissions during construction, which would mitigate their impacts during potentially dry and windy conditions.	**ES Appendix 5.3.2: Code of Construction Practice** (Doc Ref. 5.3)
Embedded mitigation – operation		
Air quality mitigation measures	All operational period measures included in the Air Quality Assessment are considered to be embedded mitigation measures.	**ES Chapter 13: Air Quality** (Doc Ref. 5.1)
Monitoring		
Monitoring included in environmental topic chapters of this ES	**ES Chapter 9: Ecology and Nature Conservation** (Doc Ref. 5.1) recommends continual monitoring of the species that are present at the site under changing climate conditions (particularly non-native species), and of the condition of water bodies providing wetland habitats. **ES Chapter 11: Water Environment** (Doc Ref. 5.1) states that Gatwick would continue to monitor the quality of water discharge to ensure that any changing rainfall patterns do not impact the water quality given expected increased de-icer quantities. Whilst winters are expected to be become warmer on average, cold weather spells would still occur up to and during the middle of this century and are expected to be the same magnitude and intensity as today.	**ES Chapter 9: Ecology and Nature Conservation** (Doc Ref. 5.1) **ES Chapter 11: Water Environment** (Doc Ref. 5.1)
Future monitoring air quality commitments	There are a range of measures including the continuation of monitoring at three sites, monitoring at new locations.	Section 106 agreement

Measures Adopted as Part of the Project	Reason	How Secured
Enhancement		
Management of, or implementation of, proposed mitigation to enhance existing green infrastructure including hedgerows, woodland, trees, shrubs, wetland and amenity planting	To enhance the character and biodiversity of the airport and surrounding landscape/townscape. To enhance the screening capacity of visually significant vegetation. Enhancement of existing green infrastructure including hedgerows, woodland, trees, shrubs, wetland and amenity planting would also increase the resilience of landscape receptors to changes in future climate.	**ES Appendix 8.8.1: Outline Landscape and Ecology Management Plan** (Doc Ref. 5.3)

Assessment of Effects

Construction

15.9.16 Consultations were carried out with authors of ES topic chapters to identify and assess potential in-combination climate change impacts. The assessment of these impacts for the construction period is presented in **ES Appendix 15.9.1: In-combination Climate Change Impacts Assessment** (Doc Ref. 5.3) and a summary is provided below.

15.9.17 The in-combination climate change impacts assessment concluded that no significant impacts were identified during the construction period given the mitigation identified above in Table 15.9.1 embedded into the Project.

Further Mitigation

15.9.18 No further mitigation is proposed during this construction period of the Project as a result of this ICCI assessment.

Future Monitoring

15.9.19 No future monitoring is proposed during this construction period of the Project on the basis that no new significant effects were identified.

Operation

15.9.20 The assessment of potential in-combination climate change impacts for the operational period is presented in **ES Appendix 15.9.1: In-combination Climate Change Impacts Assessment** (Doc Ref. 5.3) and summarised below.

15.9.21 The ICCI assessment concluded that there were no significant ICCIs identified during the operation of the Project on the basis that no new significant effects were identified.

Further Mitigation

15.9.22 No further mitigation is proposed during this operational period of the Project on the basis that no new significant effects were identified.

Future Monitoring

15.9.23 As a responsible operator, and in compliance with the evolving legislative landscape, GAL has procedures to check the efficacy of embedded mitigation measures and keep them under review on account of regulator change, other circumstances change or the prevailing climate changes; to preserve passenger and operational safety and business continuity. All ICCIs currently identified as not significant need future monitoring by GAL (see **ES Appendix 15.9.1: In-combination Climate Change Impacts Assessment** (Doc Ref. 5.3) for more detail). During operation this can be formalised and aligned with the GAL's TCFD mandatory reporting (latest example in GAL, 2023) and GAL's 5-year review cycle for the Climate Adaptation Risk Assessment (GAL, 2021a), reporting to the Government under the ARP as part of the 2008 Climate Change Act. Although currently voluntary, all major airport and infrastructure operators currently report under the ARP and this reporting may become mandatory in the future.

15.10. Cumulative Effects

15.10.1 Cumulative effects are the combined impact of a given type, from a range of different activities or sources, perhaps in conjunction with past/future development or activity (IEMA, 2020).

15.10.2 For the purposes of this assessment, the following has been used:

- The Zone of Influence for the CCR assessment is the area within the Project site boundary; and
- The Zone of Influence for the ICCI assessment is dependent on the related topic, eg water/flood risk.

15.10.3 Due to uncertainty around the third runway at London Heathrow Airport (Heathrow R3), this development has not been included in the main cumulative effects assessment. However, as Heathrow R3 remains Government policy, it has been considered separately and a qualitative assessment is provided in **ES Chapter 20: Cumulative Effects and Inter-relationships** (Doc Ref. 5.1).

15.10.4 The ICCI assessment is an assessment of the exacerbating impact of climate change on existing effects. As the climate change projections have been included within each ES topic's primary assessment and are therefore carried through to the aspect-specific cumulative effects assessment, a separate climate change cumulative effects assessment was not required.

15.10.5 The CCR assessment required consideration of the resilience of the design of elements of the Project to climate change, not the combined impact from a range of different activities, sources of other surrounding developments. An assessment of cumulative effects was not relevant to this element of the chapter.

15.11. Inter-relationships

15.11.1 An assessment of inter-related effects looks at the potential for effects on receptor groups across the Project's stages.

15.11.2 The CCR assessment is an assessment that looks at the resilience of the Project assets to future changes in climate. The inter-relationships with the other topic chapters have already been considered in the assessment within this chapter.

15.11.3 The ICCI assessment reviewed the inter-relationships between climate change and all the other environmental topics as set out in the assessment above (Section 15.9, Assessment of Effects). Therefore, a separate climate change inter-related effects assessment was not required.

15.11.4 Further information on inter-related effects is provided in **ES Chapter 20: Cumulative Effects and Inter-relationships** (Doc Ref. 5.1).

15.12. Summary

15.12.1 This Climate Change ES chapter presents the assessment of the following:

- CCR: the resilience of the design, construction and operation of the Project to projected future climate change impacts or from climate change on the project. Decommissioning has been scoped out.
- In-combination Climate Change Impacts (ICCI): the combined effects of the Project and potential climate change impacts on the receiving environment and community.

15.12.2 The CCR assessment differs from many other EIA topics in that it considered how the resilience of a development may be affected by an external factor (climate change) not how environmental receptors may be affected by a development's impacts. Consequentially, the CCR impacts cannot be assigned significance with respect to the severity of impacts in the same way as for the other environmental topics. Instead, a risk-analysis based approach was used for the CCR assessment, where any high or very high risks are deemed significant and require further mitigation.

15.12.3 The ICCI assessment followed the same approach to assessing impacts and determining significance as for each of the ES topics, but with the added consideration of future climate change projections.

15.12.4 No high or very high risks (considered significant) during the construction were identified in the CCR assessment. Therefore, no further mitigation is required. Whilst not considered necessary to avoid significant effects, additional measures may be implemented following Project refinements during detailed design stage which would further reduce the risk of any significant effect.

15.12.5 No future monitoring is proposed with regard to CCR during this construction period of the Project as embedded mitigation and the further mitigation identified are considered to be sufficient.

15.12.6 No change impacts have been determined as high or very high risk (considered significant) for during operation, which combines likelihood and consequence, therefore no further mitigation measures are required. Whilst not considered necessary to avoid significant effects, additional measures may be implemented following Project refinements during detailed design stage which would further reduce the risk of any significant effect.

15.12.7 As a responsible operator, and in compliance with the evolving legislative landscape, GAL has procedures to check the efficacy of embedded mitigation measures and keep them under review on account of regulator change, other circumstances change or the prevailing climate changes; to preserve passenger and operational safety and business continuity. All risks, especially the medium risks (not significant) (see Table 15.8.6 and **ES Appendix 15.8.1 Climate Change Resilience Assessment** (Doc Ref. 5.3) for more detail), to ensure they do not move to the high or very high rating, need regular review. During operation this can be formalised and aligned with

the GAL's TCFD mandatory reporting (latest example in GAL, 2023) and GAL's 5-year review cycle for the Climate Adaptation Risk Assessment (GAL, 2021), reporting to the Government under the ARP as part of the 2008 Climate Change Act. Although currently voluntary, all major airport and infrastructure operators currently report under the ARP and this reporting may become mandatory in the future.

15.12.8 No significant effects were identified through the ICCI assessment for the construction period of the Project. No further mitigation or future monitoring is required for construction given the embedded mitigation identified and on the basis that no new significant effects were identified.

15.12.9 No significant effects were identified through the ICCI assessment for the operational period. No further mitigation is proposed during this operational period of the Project on the basis that no new significant effects were identified.

15.12.10 As a responsible operator, and in compliance with the evolving legislative landscape, GAL has procedures to check the efficacy of embedded mitigation measures and keep them under review on account of regulator change, other circumstances change or the prevailing climate changes; to preserve passenger and operational safety and business continuity. All ICCIs currently identified as not significant need future monitoring by GAL (see **ES Appendix 15.9.1: In-combination Climate Change Impacts Assessment** (Doc Ref. 5.3) for more detail). During operation this can be formalised and aligned with the GAL's TCFD mandatory reporting (latest example in GAL, 2023) and GAL's 5-year review cycle for the Climate Adaptation Risk Assessment (GAL, 2021), reporting to the Government under the ARP as part of the 2008 Climate Change Act. Although currently voluntary, all major airport and infrastructure operators currently report under the ARP and this reporting may become mandatory in the future.

15.12.11 A summary of significance for climate resilience is provided in Table 15.12.1 and a summary of effects for In-Combination Climate Change Impacts is provided in Table 15.12.2.

Table 15.12.1: Summary of significance for Climate Change Resilience

Receptor	Receptor Sensitivity	Description of Impact	Short/medium/long-term/permanent	Risk rating	Significant/ not significant	Notes
Construction Period						
Project itself and its users – CCR Assessment	N/A	Lack of resilience of assets to extreme weather events (ie heatwaves or flooding)	Medium to long-term temporary	Medium level of risk due to existing or embedded mitigation measures in place	Risks not significant with embedded mitigation in place.	Based on the current development of mitigation secured in the CoCP, no significant effects have been identified, therefore no further mitigation, or future monitoring is required.
Operational Period						
Project itself and its users - CCR Assessment	N/A	Lack of resilience of assets to future climate change	Permanent (long-term)	Very low to medium risk with existing or embedded mitigation measures in place.	Very low to medium risks not significant	Based on the current development of mitigation, no significant effects have been identified, therefore no further mitigation is required. Future monitoring is proposed during this operational period of the Project and is considered good practice. All risks, especially the medium risks (not significant) to ensure they do not move to the high or very high rating, need regular review.

Table 15.12.2: Summary of effects for In-Combination Climate Change Impacts

Receptor	Receptor Sensitivity	Description of Impact	Short/medium/long-term/permanent	Magnitude of Impact	Significance of Effect	Significant/ not significant	Notes
Construction Period							
In-Combination Climate Change Impact (ICCI) Assessment	N/A	All identified ICCIs	Short-term temporary	Minimal	Not significant	Not significant with existing mitigation in place.	Based on the current development of mitigation, no significant effects have been identified, therefore no further mitigation or future monitoring is required.
Operational Period							
In-Combination Climate Change Impacts (ICCI) Assessment	N/A	All identified ICCIs	Longterm	Minimal	Not significant	Not significant with existing mitigation in place.	Based on the current development of mitigation, no significant effects have been identified, therefore no further mitigation is required. Future monitoring is proposed during this operational period of the Project. All ICCIs currently identified as not significant need future monitoring by GAL.

15.13. References

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15.14. Glossary

Table 15.14.1: Glossary of Terms

Term	Description
ACRP	Airports Cooperative Research Programme
Adaptive capacity	The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences (IPCC, 2022). For the Project it refers to the embedded mitigations measures that are designed in now that would add resilience to a changing climate, and also the further mitigation identified as part of this chapter that would address residual climate risk and the uncertainty around if the climate risks manifest themselves as projected. There is also the capacity of the Project to be flexible to change, and the project's capacity to adapt in the future to be more resilient. This is where the embedded mitigation measures, or planned adaptation, as part of wider Gatwick plans or policies during operation which would allow renewals or replacement of asset components (that would be replaced during the wider asset lifetime eg replacement of runway surfaces, renewal of electronic equipment) to be upgraded to be more resilient (eg tolerate higher temperatures or following the latest design standards at the time that take climate change into account) at the most relevant time frame in the future (and not now).
ANPS	Airports National Policy Statement
ARP	Adaptation Reporting Power
ARP3	Gatwick's Third Adaptation Reporting Power
AWP	Adverse Weather Plan
BEIS	Department for Business, Energy and Industrial Strategy
CAA	Civil Aviation Authority
CARE	Central Area Recycling Enclosure
CCAR	Climate Change Adaptation Report
CCC	Committee on Climate Change
CCR	Climate Change Resilience
CCRA	Climate Change Risk Assessment Climate change risk assessment is a risk assessment-based methodology for identifying potential climate impacts and assessing their severity (IEMA, 2020).
CIBSE	Chartered Institute of Building Services Engineers
Climate	The general weather conditions prevailing over a long period of time. Climate change will see trends in the climate conditions changing (seasonal averages and extremes) (IEMA, 2020).

Term	Description
Climate change adaptation	The process that a receptor or project has to go through to ensure it maintains its resilience to climate change. In the case of a development project, adaptation can be embedded in the design to account for future climate conditions, or the project can introduce measures to ensure it retains it resilience (ie the project adapts) to future climate conditions. Environmental receptors will adapt to climate change in varying degrees depending on how vulnerable they are to climate (IEMA, 2020).
Climate change mitigation	Measures included in a project to reduce the emissions of greenhouse gases.
Climate change projection	The range of possible climate conditions projected for a range of probability that the conditions will occur for a specific carbon emissions scenario (IEMA, 2020).
CMP	Convection-permitting model
CoCP	Code of Construction Practice
DCO	Development Consent Order
DEFRA	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EASA	European Union Aviation Safety Agency
EIA	Environmental Impact Assessment
Embedded mitigation	Measures identified as part of the Project that are embedded into the design of the Project. This comprises both Primary mitigation (mitigation that is part of the Project, eg a reduction in height of a particular structure to reduce visual effects or planting to offset an ecological effect) and Tertiary mitigation (these are legislative or standard/good practices that would be required without EIA, eg. Legislative/good practice measures within a CoCP). Not to be confused with climate change mitigation (see above).
Enhancement measure	Strengthening of positive impacts, in relation to climate resilience.
ES	Environmental Statement
FRA	Flood Risk Assessment
Further mitigation	These are (secondary) mitigation measures that could further prevent/offset effects, particularly where significant adverse effects are identified in the assessment that already takes into account embedded mitigation. Not to be confused with climate change mitigation (see above).
Future monitoring	Monitoring to check the assumptions remain valid.
GHG	Greenhouse Gas
HVAC	Heating, ventilation and air conditioning
ICAO	International Civil Aviation Organization

Term	Description
ICCI	In-Combination Climate Change Impact When a projected future climate impact (eg increase in temperatures) interacts with an effect identified by another topic and exacerbates its impact. For example, if the biodiversity topic identifies an effect on a habitat or species receptor due to a project/scheme, such as loss of habitat, and in addition projected future higher temperatures would increase the vulnerability of this habitat to fragmentation, this is an ICCI.
IEMA	Institute of Environmental Management and Assessment
IPCC	Intergovernmental Panel on Climate Change
oLEMP	Landscape and Ecology Management Plan
NAP	National Adaptation Programme
NN NPS	National Networks National Policy Statement
NOAA	US National Oceanic and Atmospheric Administration
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NPS	National Policy Statement
PEI	Preliminary Environmental Information
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PPCE	Probabilistic Projections of Climate Extremes
Projection	A possible outcome defined by modelling of climate variables to give a possible outcome. This is in contrast to a prediction which is a statement of probable change.
RCP	Representative Concentration Pathway
Significance	Significance is assessed by comparing the magnitude of an impact with a receptor's value, sensitivity, permanence or reversibility, in an assessment-specific matrix. The criteria in this matrix can be pre-set, allowing for objective impact assessment rather than subjective impact evaluation (IEMA, 2020).
SoS	Secretary of State
TCFD	Task Force for Climate-Related Disclosures
TWG	Topic Working Group
UHI	Urban Heat Island
UKCP	UK Climate Projections
UKCP09	The previous 2009 climate projections produced by the UK Met Office.
UKCP18	The most recent climate projections produced by the UK Met Office Hadley Centre, these represent an update from the UKCP09 projections. The new projections use Representative Concentration Pathways (RCPs) rather than the previous 'low, medium, high' emission scenarios (IEMA, 2020).
Weather	Weather is what we experience on a daily basis. It is defined by the atmospheric conditions (such as temperature, wind, cloud cover, rain) prevailing at specific moments in time, or over short time periods (IEMA, 2020).

Term	Description
WSI	Written Scheme of Investigation
WTW	Water Treatment Works proposed as part of the Project.