



YOUR LONDON AIRPORT
Gatwick

*Our northern runway:
making best use of Gatwick*

Preliminary Environmental Information Report Chapter 15: Climate Change and Carbon

September 2021

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15 Climate Change and Carbon

15.1. Introduction

15.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the findings of the Environmental Impact Assessment (EIA) work undertaken to date concerning the potential effects of the proposal to make best use of Gatwick's existing runways (referred to within this report as 'the Project') on climate change and carbon.

15.1.2 This chapter 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.
- **In-combination Climate Change Impacts (ICCI):** the combined effects of the Project and potential climate change impacts on the receiving environment and community.
- **Greenhouse Gas Emissions¹ (GHG):** the likely effect of the Project on GHG emissions. Throughout this document the term 'carbon' has been used as shorthand to refer to greenhouse gases². An exception to this general reporting approach relates to aviation emissions where carbon dioxide (CO₂) emissions alone are reported (excluding other GHGs). The chapter considers GHG emissions from two groupings of activities:
 - Construction-related emissions arising from the extraction, processing and manufacture of construction materials; transportation of these materials; the energy and water used during construction processes; transport and disposal of waste; and transport of construction workers.
 - Operational emissions comprising emissions from aircraft on the ground, in the Landing and Take-off (LTO) cycle and Climb-Cruise-Descent (CCD) stage; surface access (transport) of passengers, staff and freight; and the operation of airport buildings, assets and vehicles including energy use (heating/cooling/power), provision of potable water, treatment of waste water, waste treatment, fuel consumption in vehicles and mobile plant, Auxiliary Power Units (APU), Ground Power Units (GPU), Fixed Electrical Ground Power (FEGP), Ground Support Equipment (GSE), firefighting activities and aircraft engine testing.

15.1.3 In particular, this PEIR chapter:

- sets out the existing and future environmental baseline conditions, established from desk studies and consultation to date;

¹ Greenhouse gases are defined as those gases within the 'Kyoto basket' ie carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride (SF₆). Other non-Kyoto emissions are considered likely to contribute to climate change (both through warming and cooling effects) including through radiative forcing mechanisms. Further detail on these emissions, and the level of understanding around their effects and impacts, can be found in the Committee on Climate Change (CCC) 2009 Report "Meeting the UK aviation target - options for reducing emissions to 2050 (CCC, 2009) and in the CCC's Sixth Carbon Budget report (CCC, 2020). The recent Jet Zero consultation from UK Government explicitly references Non-CO₂ impacts and notes that the impact of these emissions has a large degree of uncertainty. The consultation notes that the UK Government is seeking to improve understanding of these impacts and will use most recent available information in the formation of policy. This is further discussed in section 15.4.7 below..

² GHGs are quantified by mass. To provide a single metric GHGs other than CO₂ are converted into 'CO₂ equivalent' (CO₂e) which (where applicable) have been added to the emissions of CO₂ to provide a single quantification.

- presents the potential environmental effects on climate change and carbon arising from the Project, based on the information gathered and the analysis and assessments undertaken to date;
- identifies any assumptions and limitations encountered in compiling the environmental information; and
- 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 accompanied by Appendices 15.2.1: Summary of Local Planning Policy, 15.3.1 Summary of Stakeholder Consultation, 15.4.1: Climate Change and Carbon Technical Appendix, 15.4.2: CCR Assessment Definitions, Appendix 15.9.1 CCR Assessment, Appendix 15.9.2 ICCI Assessment and Figures 15.6.1 and 15.6.2.
- 15.1.5 A technical appendix setting out the Draft Energy Strategy which has informed the GHG assessment is presented in Appendix 5.4.1 of the PEIR.
- 15.1.6 The PEIR will inform pre-application consultation. Following consultation, comments on the PEIR will be reviewed and taken into account in preparation of the Environmental Statement (ES) that will accompany the application to the Planning Inspectorate for development consent for the Project. The application will also incorporate the draft Carbon and Climate Change Action Plan (see section 15.8 on Mitigation) specifying the actions to be taken by Gatwick to reduce climate impacts from the construction and operation of the airport, and to fulfil its role in supporting decarbonisation of the wider aviation sector.

15.2. Legislation and Policy

Legislation

- 15.2.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 requires a description of the factors likely to be significantly affected by the development including climate (for example greenhouse gas 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 greenhouse gas 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 (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 Secretary of State directed a number of infrastructure owners and operators, including Gatwick, to input to the first round of reporting. The second round of reporting was, and the third round will be, 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 the first and second rounds of reporting. The third round of reporting is underway and will be published in 2021. These existing adaptation reporting processes are relevant to this PEIR assessment as all climate change risk

assessment and associated environmental measures identified through this assessment will feed into Gatwick's reporting thereafter.

- 15.2.4 The CCAR must be prepared at no longer than five yearly intervals. To date two CCARs have been produced (Department for Environment, Food and Rural Affairs (Defra), 2012 and 2017). Paragraph 4.49 of the Airports National Policy Statement (NPS) (Department for Transport, 2018a) requires that adaptation measures proposed in relation to new airport infrastructure are based on the most recent CCAR (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 Adaptation 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 climate change risk assessment reporting under Section 56 has been completed (s58(2) and (3)).
- 15.2.7 The amended Section 1 of the Climate Change Act 2008 sets a GHG emissions reduction target for the UK of 100 per cent by 2050, compared to a 1990 baseline (the 'Net Zero' target). This revised target was introduced in 2019 as a change from the previous 80 per cent reduction target. The Committee on Climate Change (CCC) establishes five-year national carbon budgets to achieve this target.
- 15.2.8 The establishment of carbon budgets respond to the Paris Agreement which provides for the international community to keep the increase in global average temperatures to well below 2°C above pre-industrial levels, and to pursue efforts to limit the temperature increase to 1.5°C. The UK's Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) in line with Article 4 of the Paris Agreement commits the UK to reducing economy-wide greenhouse gas emissions by at least 68% by 2030, compared to 1990 levels.
- 15.2.9 The most recent UK carbon budget recommendation was the Sixth Carbon Budget (CCC, 2020) covering the period 2033-37 which was the first to fully reflect the revised Net Zero target for 2050. The Sixth Carbon Budget was adopted by the UK Government in 2021. Following recommendations by the CCC the Sixth Carbon Budget formally includes emissions from international aviation within the target of 965 MtCO_{2e}, a 78% reduction on 1990 levels. Prior to this UK carbon budgets included only domestic aviation emissions and left 'headroom' within the budget for international aviation (and shipping) emissions.
- 15.2.10 The adoption of a net zero target in the UK under the Climate Change Act has recently been reflected for the transport and aviation sectors in the publication of the Transport Decarbonisation Plan (DfT, 2021a) and the accompanying Jet Zero consultation (DfT, 2021b) which sets out the proposal to introduce a trajectory to Net Zero for the aviation sector in the UK. This is proposed to incorporate a range of measures to reduce sectoral emissions, and for offsetting and GHG removals to reduce residual emissions to Net Zero.

- 15.2.11 The Greenhouse Gas Emissions Trading Scheme Order (2020) provides the legislation which implements the UK Emission Trading Scheme (UK ETS). This is a cap-and-trade mechanism which includes aviation emissions. It replaced, for the UK, the role of the EU ETS following the UK’s exit from the European Union. The UK has consulted on how the UK ETS will integrate with wider industry initiatives to reduce GHG emissions (DfT, 2021c) – specifically the ICAO’s Carbon Offsetting and Reduction Scheme for International Aviation (CORSA) which is a global market-based measure whereby offsetting is used to reduce sectoral emissions to agreed levels.

Planning Policy Context

National Policy Statements

- 15.2.12 The Airports NPS (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 south east of England.
- 15.2.13 The NPS for National Networks (Department for Transport, 2015) 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 made³. This has been taken into account in relation to the highway improvements proposed as part of the Project.
- 15.2.14 Table 15.2.1 provides a summary of the relevant requirements of these NPSs and how these are addressed within the PEIR.

Table 15.2.1: Summary of NPS Information Relevant to this Chapter

Summary of NPS Requirement	How and Where Considered in the PEIR
Airports NPS	
Paragraphs 4.46-4.52 of the NPS are of relevance to the CCR and ICCI and are summarised below:	
1. The range of impacts of climate change must be considered using the latest UK climate projections and appropriate mitigation or adaption measures identified.	1. The assessment identifies climate change impacts using UK Climate Projections (UKCP18) (the latest set of UK climate change projections) (Met Office, 2018a), as described in Section 15.6 of this chapter. Section 15.8 sets out how embedded environmental measures would be implemented in relation to climate change.
2. To assess the impacts of climate change, the applicant should apply the latest UK climate projections considering a scenario that reflects GHG emissions at the 10%, 50% and 90% probability levels.	2. The use of probability levels from the 10 th to the 90 th percentile, including the 50 th percentile, is described in Table 15.6.7, Table 15.6.8, Table 15.6.9 and Table 15.6.10 of this assessment.
3. There should be no critical features of infrastructure design which may be seriously	3. In preparing this PEIR, climate model outputs from the UKCP18 have been used and the assessment has used

³ It is noted that the Transport Decarbonisation Plan published by the Department for Transport (DfT) on 14 July 2021 announced DfT’s intention to review the NPS for National Networks in due course once demand patterns post-pandemic become clearer. It is understood DfT intend to commence the review by the end of 2021 and complete it by Spring 2023. In the interim and whilst the review is undertaken, DfT have confirmed the NNPNS remains relevant government policy and has full force and effect for the purposes of the Planning Act 2008.

Summary of NPS Requirement	How and Where Considered in the PEIR
<p>affected by more radical changes to climate beyond those projected in the latest UK climate projections.</p>	<p>proportionate and appropriate methods considered to be suitable at this time, as described in Section 15.4. More radical changes to the climate have not been considered at this stage but will be assessed through use of the H++ climate change scenarios (Met Office, 2015), which is the only information available at the current time from the Met Office regarding more extreme changes to climate beyond those in the UKCP18 projections. These assessments will take the form of a sensitivity analysis and will be included in the ES.</p> <p>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. As part of the ES, the Client will need to confirm its interpretation of 'radical changes to climate' and identify how climate resilient it wants the infrastructure design to be.</p>
<p>4. Adaptation measures should be based on the latest UK climate projections, most recent UK climate change risk assessment, consultation with statutory bodies and any other appropriate data.</p>	<p>4. The consideration of the UK Climate Change Risk Assessment (CCRA) (Defra, 2017) in the methodology is described in Section 15.4 of this chapter. Table 15.3.1 sets out the responses to Planning Inspectorate comments and Table 15.3.2 outlines engagement with key stakeholders. Mitigation measures have been developed to manage risks. These are described in Section 15.8.</p>
<p>5. If any proposed measures give rise to consequential impacts, the Secretary of State will consider the impact in relation to the application as a whole and the principles of the Airports NPS.</p>	<p>5. The consequential impacts of embedded mitigation in other aspects have been assessed in individual topic chapters within this PEIR. Mitigation identified for climate change has been recorded in Section 15.8; any potential consequential effects have been considered in Section 15.9.</p>
<p>6. Adaptation measures can be implemented at the time of construction where necessary.</p>	<p>6. Elements of the design have been developed to account for climate change adaption and will be implemented at the time of construction.</p>
<p>7. The Secretary of State can require the applicant to ensure that adaptation measures be implemented should the need arise, rather than at the outset of the development.</p>	<p>7. Future adaptation measures are being developed as part of the design.</p>
<p>8. Paragraphs 5.69 and 5.70 state the Government's objective for the aviation sector to contribute to reducing global GHG emissions.</p>	<p>8 - 10. Both the scope of the assessment and the methodology are aligned with the NPS requirements.</p>

Summary of NPS Requirement	How and Where Considered in the PEIR
9. Paragraphs 5.71 to 5.73 explain how the CCC leave a headroom in their five-year UK carbon budgets that account for international aviation.	
10. Paragraph 5.74 outlines the activities with potential to increase GHG emissions: air transport; airport buildings and ground operations; surface access; and construction.	
11. Paragraphs 5.76 and 5.77 provide guidance for the EIA process, including the scope and scenarios that should be covered.	11. The GHG assessment provides preliminary evidence of the carbon impact against the Government’s carbon obligations and quantifies the GHG effects of the Project without mitigation scenario. The assessment quantifies the impacts including emissions from aviation; surface access due to airport and construction staff; emissions from surface access due to freight and retail operations and construction site traffic; emissions from surface access due to airport passengers and visitors; emissions from airport buildings and ground operations including energy and fuel use. Section 15.9 sets out the GHG emissions for the key reporting years.
12. Paragraphs 5.78 to 5.80 outline potential mitigation measures and state that <i>“the applicant is expected to take measures to limit the carbon impact of the project”</i> .	12. Section 15.8 sets out the environmental mitigation measures for the Project and quantifies the adequacy of these measures for reducing the impact of the Project on GHG emissions.
13. Paragraphs 5.82 and 5.83 state: <i>“Any increase in carbon emissions alone is not a reason to refuse development consent, unless the increase in carbon emissions resulting from the project is so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets, including carbon budgets.”</i> <i>“The Secretary of State’s view of the adequacy of the mitigation measures relating to design, construction and operational phases will be a material factor in the decision-making process.”</i>	13. Section 15.9 addresses the significance of the effect on GHG emissions and addresses the NPS requirement to assess whether the Project has a material impact on the UK Government’s ability to meet its carbon reduction targets including the CCC’s carbon budgets. Section 15.8 sets out the environmental mitigation measures for the Project.
NPS for National Networks	
14. Paragraph 4.37 of the NPS is of relevance to the CCRA and ICCI: <i>‘how the NPS puts Government policy on climate change adaptation into practice, and in particular how applicants and the Secretary of State should</i>	14. The assessment uses UKCP18 projections (which have superseded the UKCP09 projections) using Representative Concentration Pathway (RCP) 8.5 emissions scenario ('high') across the range of probability

Summary of NPS Requirement	How and Where Considered in the PEIR
<p><i>take the effects of climate change into account when developing and consenting infrastructure.</i>'</p> <p>The NPS wording is similar to that in the Airports NPS except in paragraph 4.41 which specifies that: <i>'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.'</i></p>	<p>levels from 10th - 90th percentile therefore the assessment includes the 50th percent probability level.</p>
<p>15. Paragraphs 5.16 to 5.19 of the NPS are of relevance to the GHG assessment and are summarised below.</p>	<p>15 - 17. Section 15.9 assesses whether the Project has a material impact on the UK Government's ability to meet its carbon reduction targets including the CCC's carbon budgets.</p>
<p>16. Paragraph 5.16 states that the CCC's UK carbon budgets take into account an allowance for new national road infrastructure which is compatible with meeting the Climate Change Act target for 2050⁴.</p>	
<p>17. Paragraph 5.17 explains that any carbon impacts should be included at the option appraisal stage and as part of the EIA for the DCO application, and that applicants should provide evidence of the carbon impacts and assess them against the carbon budgets.</p>	
<p>18. Paragraphs 5.18 and 5.19 explain how carbon increases from road development are included in the UK carbon budget and state the following: <i>"any increase in carbon emissions is not a reason to refuse development consent, unless the increase in carbon emissions resulting from the proposed scheme are so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets."</i></p> <p><i>"Evidence of appropriate mitigation measures (incorporating engineering plans on configuration and layout, and use of materials) in both design and construction should be presented. The Secretary of State will consider the effectiveness of such mitigation measures in order to ensure that, in relation to design and construction, the carbon</i></p>	<p>18. Section 15.8 sets out the environmental mitigation measures for the Project and quantifies the adequacy of these measures for reducing impact of the Project on GHG emissions.</p>

⁴ At the time of its production the UK Climate Change Act was targeting an 80% reduction by 2050

Summary of NPS Requirement	How and Where Considered in the PEIR
<p><i>footprint is not unnecessarily high. The Secretary of State’s view of the adequacy of the mitigation measures relating to design and construction will be a material factor in the decision-making process.”</i></p>	

National Planning Policy Framework

- 15.2.15 The National Planning Policy Framework (NPPF) (Ministry of Housing, Community and Local Government, 2021) sets out the planning policies for England. Chapter 14 of the NPPF sets out the approach to meeting the challenge of climate change.
- 15.2.16 Paragraph 154 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...’.*
- 15.2.17 Paragraph 157 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...’.*
- 15.2.18 The NPPF requires a risk-based approach to avoid vulnerability associated with flood risk and climate change. The methodology outlined in Section 15.4 of this chapter ensures that the vulnerability of the Project to climate change is assessed, and environmental measures are implemented to ensure risks are managed.
- 15.2.19 Paragraph 155 of the NPPF states that plans should help to increase the use and supply of renewable and low carbon energy and heat by providing a positive strategy for deriving energy from these sources; identifying suitable areas for renewable and low carbon energy sources; and identifying opportunities for the development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.
- 15.2.20 The GHG emissions methodology and assessment described in Sections 15.4 and 15.9 respectively have been developed in line with the NPPF guidance.

Other Relevant National Planning Policy

- 15.2.21 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. These allowances take the form of percentage uplifts for streamflow and precipitation for drainage design.
- 15.2.22 The UK Aviation Policy Framework (Department for Transport, 2013) outlines the Government’s policy framework for the UK aviation sector. With respect to climate change, paragraph 12 states that the UK Government’s objective is to: *‘ensure that the aviation sector makes a significant and cost-effective contribution towards reducing global emissions’.*

15.2.23 The Aviation 2050 strategy (Department for Transport, 2018b) reviews the climate change policies detailed in the Aviation Policy Framework. This document has recently undergone public consultation and, as such, does not represent currently adopted policy. Paragraph 3.87 of the strategy states that the Government agreed with the (then) CCC's advice to exclude international aviation emissions from carbon budgets but to leave 'headroom' to account for international aviation so that the whole economy is on a trajectory to achieve the 2050 Climate Change Act target⁵. The paragraph also states that:

'To set a clear level of ambition for the sector, the government proposes to: accept the CCC's recommendation that emissions from UK-departing flights should be at or below 2005 levels in 2050.'

15.2.24 2018 Beyond the Horizon - Making best use of existing runways (DfT, 2018d) represents current UK Government policy on aviation and climate change. It 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.

15.2.25 As set out in Section 15.2.7 the recently published recommended Sixth Carbon Budget now includes international aviation.

15.2.26 Decarbonising Transport (the Transport Decarbonisation Plan) (Department for Transport, 2021a) sets out the Government's approach to decarbonising the full transport sector in the UK. The strategic priorities included are across modal shift and active transport; decarbonisation of road transport; decarbonising the freight system; green transport technology and innovation; place-based solutions; and reducing carbon in the global economy. The Plan sets out a wide range of commitments and actions to promote change across these priorities, many of which will directly seek to reduce GHG impacts arising from surface access, freight transportation, direct emissions from airports and, emissions from aircraft. The Plan confirms the UK Government's commitment to ensure continued access to affordable flights and seeks to align this with national carbon commitments through a range of commitments and strategic priorities including:

- consultation on a Jet Zero strategy, setting out the steps to be taken to reach net zero aviation emissions by 2050 (discussed further below);
- inclusion of international aviation in the sixth Carbon Budget;
- the Jet Zero Council to support the delivery of global leadership on the production and commercialisation of Sustainable Aviation Fuels, supported by a potential mandate for blending Sustainable Aviation Fuel (SAF) by 2025;
- consultation on a target for UK domestic aviation to meet net zero by 2040;
- focus on the acceleration of technical innovation in zero emissions aircraft technologies;
- research and development on zero emissions flight infrastructure at UK airports;
- supporting UK airspace modernisation;
- industry mechanisms to reduce sectoral emissions including further development of the UK ETS which covers flights within the European Economic Area (EEA) and flights to/from Gibraltar (potentially to consider other pollutants) and interaction with the global offsetting scheme for aviation, CORSIA;
- international leadership to agree a long-term global emissions reduction goal through the UN International Civil Aviation Organisation (ICAO) by 2022; and

⁵ This has now been superseded by the Sixth Carbon Budget recommendations from the CCC, and the inclusion of international aviation within the formal adoption of the Sixth Carbon Budget.

- consideration of how existing market-based mechanisms (UK ETS and CORSIA), as well as the use of new GHG removal technologies, can address residual emissions.

Emerging National Policy

- 15.2.27 Jet zero consultation: a consultation on our strategy for net zero aviation (Department for Transport, 2021b) was published alongside the Transport Decarbonisation Plan, and sets out the Government's proposed approach and principles to reach net zero aviation by 2050. It sets out the priorities of the UK Government to ensure the decarbonisation of aviation such that the benefits of air travel are preserved, while maximising the benefits that can accrue from aviation sector decarbonisation. The consultation notes the need for clear goals for decarbonisation while acknowledging the pathway to achieve this will require flexibility across technological development, alternative fuels, offsetting and sequestration of carbon, and other measures. It also identifies the role of the UK Government and aviation sector in delivering international leadership in achieving long term goals for GHG emissions.
- 15.2.28 The consultation includes the potential adoption of a net zero target for UK domestic aviation by 2040 in line with recommendations from the CCC. The consultation also proposes to set a CO₂ emissions reduction trajectory for aviation from 2025 to 2050 against which progress can be monitored.
- 15.2.29 The consultation sets out five areas of measures for consideration.
- **System efficiencies:** conventional aircraft efficiency improvement; airspace modernisation; and airport operational efficiencies; and mechanisms to encourage improvement in these areas through: target setting, working with airlines, airport charging / slot allocation, Air Navigation Service Provider charging, and stimulation of investment. The consultation proposes that all airport operations in England should be zero emissions by 2040 (Scope 1 and 2 emissions).
 - **Sustainable Aviation Fuels:** consultation on a SAF mandate to require blending of SAF with kerosene in addition to potential expansion of the Renewable Transport Fuel Obligation to support SAF production; ensuring a policy framework required to provide confidence to SAF producers; development of SAF standards; use of SAF on Public Service Obligation (PSO) routes; and work to accelerate procurement and use of SAF.
 - **Zero Emission Flight (ZEF):** supporting research and development in zero carbon flight including aircraft technologies and airport infrastructure needs; development of a UK Hydrogen Strategy; working with industry to encourage adoption of zero emission aircraft and aviation technology; an enabling regulatory framework to support ZEF; and use of ZEF on PSO routes.
 - **Markets and Removals:** implementing CORSIA in 2024 and ensuring aviation is appropriately considered within the UK ETS; considering inclusion of other pollutants in UK ETS; detailing the UK Govt approach to deploying GHG removal methods including through UK ETS; negotiating for carbon pricing to be maintained and strengthened and incentivising GHG removal methods; and encouraging increased ambition of CORSIA through international negotiation.
 - **Influencing Consumers:** potentially mandating provision of environmental information to customers and supporting consumers to make sustainable choices.
- 15.2.30 The consultation document also specifically addresses non-CO₂ impacts such as contrails and NO_x emissions, acknowledging that the scale of the effect from these has a large degree of

scientific uncertainty. The consultation notes that many measures to improve efficiencies will help to reduce non-CO₂ emissions, and commits to ensuring that the latest scientific knowledge is used to inform aviation policy.

- 15.2.31 The consultation period began on 14 July 2021 and will run until 8 September 2021. It is understood that the DfT will publish a summary of responses, including the next steps, within three months of the consultation closing. Its output will be considered as necessary as part of the ES supporting the application for development consent.

Local Planning Policy

- 15.2.32 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 Council to the north east and Horsham District Council to the south west. The administrative area of Tandridge District Council is located approximately 1.9 km to the east of Gatwick Airport, while Mid Sussex District Council lies approximately 2 km to the south east. Gatwick Airport is located in the county of West Sussex and adjacent to the county of Surrey.
- 15.2.33 The most relevant local planning policies applicable to climate change are summarised in Table 15.2.2 and explained further in Appendix 15.2.1. For some environmental topics that have informed this chapter, a wider study area has been used and 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	ENV6 Sustainable design and construction
		GAT1 Development of the Airport with a Single Runway
		SD1 Presumption in favour of sustainable development
		ENV7 District energy networks
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
		CCF1 Climate change mitigation
		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 36 Appropriate energy use
		Policy 37 Sustainable design and construction
Tandridge	Tandridge District Core Strategy 2008	CSP14 Sustainable construction
		CSP15 Environmental quality

Administrative Area	Plan	Policy
Mid Sussex	Mid Sussex District Plan 2014-2031	DP39: Sustainable Design and Construction
Emerging Policy		
Crawley	Submission Draft Crawley Borough Local Plan 2021-2037	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 2018-2033 Consultation Draft Local Plan	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	Strategic Policy 1 – Sustainable Development
		Strategic Policy 37 – Climate Change
		Strategic Policy 40 – Flooding
Tandridge	Our Local Plan: 2033	TLP30 Green and Blue Infrastructure
		TLP47: Sustainable Drainage and Reducing Flood Risk
		TLP45: Energy Efficient & Low Carbon Development

15.3. Consultation and Engagement

- 15.3.1 In September 2019, Gatwick submitted a Scoping Report (GAL, 2019) to the Planning Inspectorate, 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 phases 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.
- 15.3.2 Following consultation with the statutory bodies, the Planning Inspectorate (on behalf of the Secretary of State) provided a Scoping Opinion on 11 October 2019 (Planning Inspectorate, 2019).
- 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 addressed within the PEIR.

Table 15.3.1: Summary of PINS Scoping Responses

Details	How/where addressed in PEIR
<p>Include a description and assessment of significant effects on climate and vulnerability of project to climate change</p>	<p>See Section 15.9</p>
<p>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.</p>	<p>A description of the adaptive capacity in the Project will be included in the final ES. The PEIR assessment is based on the design at this stage of the Project development. 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 ICCI assessment in Appendix 15.9.2).</p> <p>As the project design is further refined in the build up to application, its adaptive capacity will be further considered and incorporated into the ES. This assessment will be informed by any specific client requirements with respect to adaptive capacity, whether in relation to climate resilience or other factors.</p>
<p>The Inspectorate recommends that the ES assesses the impact on arriving flights to the extent that the new airspace design affects the arriving traffic consistent with the CAP1616a requirements.</p>	<p>Airspace design changes fall under a different regulatory system and consenting process. This PEIR does not include an assessment of international arriving flights as recommendations on their inclusion are only applicable to assessments of airspace design changes. In addition, there is insufficient information on future airspace changes to allow an assessment on GHG emissions to be carried out at this stage. It is proposed to consult with CAA to discuss the scope of the assessment in the EIA process and the final ES will take into account the outcomes of the CAA consultation. Further information is provided in Chapter 4: Existing Site and Operation section 4.5; and in Chapter 6: Approach to Environmental Assessment section 6.2.</p>
<p>The Inspectorate considers that a cumulative assessment should be undertaken, to take into consideration other plans or projects which could result in significant cumulative GHG emissions.</p>	<p>The nature of greenhouse gases is that their impact is not affected by the location of their source. Emissions from proposed developments adjacent to Gatwick are no more relevant than emissions elsewhere in the UK. The measure of cumulative emissions at a national scale is carried out by the</p>

Details	How/where addressed in PEIR
	setting of, and monitoring against, UK climate budgets. Comparison with UK climate budgets is included in the PEIR.
The baseline should be presented within the ES, with appropriate referencing to the existing reports.	The baseline environment is described in Section 15.6
Explain the applicability of the existing Adverse Weather Plan and Flood Management Plan to the assessment of likely significant effects from the Proposed Development and how adherence will be secured.	Mitigation included as part of the Adverse Weather Plan (AWP) has been included within the mitigation section of the CCR assessment (Appendix 15.9.1). There is no separate Flood Management Plan to the AWP.
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 has been used in the assessment. Details of the data used can be found in Section 15.6. The impact of future climate change conditions on the design of the Project have been described in Section 15.9.
The ES should provide a clear definition for each of the different 'scopes' of emissions reported.	The PEIR makes reference to 'scopes' in Section 15.4.11 where they are referenced and a definition for each is provided. However, GAL does not consider the use of 'scopes' supports a clear assessment of the GHG impacts of the Project. The remainder of the PEIR chapter, and the supporting appendices, illustrate which emissions fall within responsibility of Gatwick Airport Ltd as airport operator, which arise from other parties (such as passengers) and which arise from aircraft.
The Inspectorate acknowledges that technological advances of aircraft, and thus changes to emissions, are difficult to predict with confidence. The Inspectorate welcomes the intention to adopt pessimistic, best practice and central projections for future aviation improvements. The Applicant should ensure that the assumptions made in all GHG calculations (for both construction and operational phases) are clearly set out in the ES.	This chapter of the PEIR provides details on the methodology adopted in Section 15.9, including assumptions made.
The ES should explain how climate change risks relate to the assessment of likely significant effects. Any design commitments that are relied upon should ensure no high risks to the Proposed Development should be appropriately described and secured.	See Section 15.9.
The ES should assess all types of GHGs which have the potential to contribute to a likely significant effect on	It is not considered that other non-Kyoto emissions should be assessed within the ES. This would be inconsistent with how other airport developments

Details	How/where addressed in PEIR
climate, and clearly set out the conversion methodology and assumptions where tCO ₂ e metrics are used.	have been assessed. Further information is included in the PEIR to explain why non-Kyoto emissions are excluded in Section 15.4.7. This will be discussed further during the EIA process.
The Inspectorate would expect to see the 'worst case' year presented as a separate assessment scenario which should be considered against a do-nothing scenario for that same year.	An assessment of the 'worst case' year for GHG emissions, and a comparison against the future baseline, is included in Section 15.9.
Therefore, the difference in GHG emissions from the 'do-nothing' and 'do-something' scenarios will be calculated and will be compared against relevant carbon budgets. The ES should assess the likely significant effects associated with any increase in GHG emissions as a result of the Proposed Development and with reference to relevant legislation and sector specific carbon budgets.	The PEIR presents the absolute magnitude of emissions and also the difference between these emissions and the baseline conditions. Emissions are then assessed against the relevant carbon budgets. For the PEIR the emissions are presented without mitigation implemented. In the ES the reported impacts will take into account best available knowledge of the impacts and innovations in reducing emissions from aircraft (technological improvements in aircraft and changes in fuels).
The ES should quantify the GHG impacts before and after mitigation to show the anticipated effectiveness of the proposed mitigation. Any mitigation relied upon to reduce the significance of effect should be demonstrably secured.	The PEIR does not present quantified mitigation. This will be presented in the final ES and will incorporate mitigation during the construction phase, but also during operation. The mitigation provided in the ES will draw from the Carbon and Climate Change Action Plan currently in development which will also be submitted alongside the development consent submission. Mitigation will also reflect the surface access and energy strategies developed for Gatwick. The range of mitigation opportunities being considered are set out in Section 15.8.3.

15.3.4 Key issues raised during consultation and engagement with interested parties specific to this topic are listed in Table 15.3.2, together with details of how these issues have been addressed within the PEIR.

Table 15.3.2: Summary of Consultation

Consultee	Date	Details	How/where addressed in PEIR
Local Authorities			
Crawley Borough Council, Reigate and Banstead Borough Council, Mole Valley District	28 August 2019	Meeting of local authorities, Gatwick Airport Ltd and air	No change was made to the scope of the assessment in

Consultee	Date	Details	How/where addressed in PEIR
Council, West Sussex County Council, Surrey County Council, Horsham District Council, Mid Sussex County Council, East Sussex County Council, Kent County Council		quality, climate change and GHG topic leads. Clarification sought on the scope of GHG emissions assessment for aircraft. Additional information was provided to the local authority which made the enquiry.	response to this. No issues arose for the CCRA and ICCI.
Wider Stakeholders			
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	Scope of EIA topic assessment for air quality, climate change and carbon topics	No issues arose for the assessment of climate change and carbon.
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 formal statutory consultation in Spring 2020.	Whilst questions were asked about the assessment no further issues arose for the assessment.
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 formal statutory consultation in Autumn 2021.	Whilst questions were asked about the assessment no further issues arose for the assessment.

15.4. Assessment Methodology

Relevant Guidance

- 15.4.1 In addition to the requirements of the EIA Regulations, the following guidance relevant to CCR, ICCI and GHG assessments has been considered. 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.

Table 15.4.1: Technical Guidance Relevant to the Climate and Carbon Assessments

Relevant topic	Technical guidance
Climate change (CCRA and ICCI)	Institute of Environmental Management and Assessment (IEMA) (2020) Climate Change Resilience and Adaptation
	International Civil Aviation Organization (ICAO) (2010): Environmental Report 2010. Chapter 6: Adaptation
	Airports Cooperative Research Programme (ACRP) (2015): Climate Change Adaptation Planning: Risk Assessments for Airports
	Civil Aviation Authority (CAA) (2014): Review of Operational Resilience at Heathrow and Gatwick
	Climate Change Adaptation Report (Civil Aviation Authority, 2015). CAP 1363
	Climate Change Adaptation Report – At Gatwick Airport (GAL, 2011)
	Climate Change Adaptation Progress Report (GAL, 2016)
	Committee on Climate Change (2017) UK Climate Change Risk Assessment Evidence Report
	Chartered Institution of Building Services Engineers (CIBSE) (2014) Technical Memorandum 49: Design Summer Years for London
	UKCP18 Science and user guidance reports. https://www.metoffice.gov.uk/research/collaboration/ukcp/guidance-science-reports
Greenhouse Gas (GHG) Assessment	The Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2017)
	The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) (2015)
	Net Zero – the UK’s contribution to stopping global warming (CCC, 2019)
	The Sixth Carbon Budget (CCC,2020)
	PAS 2080 Carbon Management in Infrastructure (British Standards Institute (BSI) 2017)
	BS EN 15978 Sustainability of construction works (BSI, 2011)
	The Royal Institution of Chartered Surveyors (RICS) Methodology to calculate embodied carbon (RICS, 2014)
Scope of carbon budgets: Statutory advice on inclusion of international aviation and shipping (CCC, 2012)	

Relevant topic	Technical guidance
	EMEP/EEA Air Pollution Inventory Guidebook (EEA, 2016)
	CORSIA (Carbon offsetting and Reduction Scheme for International Aviation) (ICAO, 2016)
	Aircraft Engine Emissions Databank (AEED) (ICAO) (EASA, 2019)
	Fifth Assessment Report (AR5) Synthesis Report (Intergovernmental Panel on Climate Change (IPCC), 2014)

Scope of the Assessment

- 15.4.2 The scope of the assessment set out in this chapter of the PEIR has been developed in consultation with relevant statutory and non-statutory consultees as detailed in Table 15.3.1 and Table 15.3.2.
- 15.4.3 Taking into account the scoping and consultation process, Table 15.4.2 summarises the issues considered as part of this assessment.

Table 15.4.2: Issues Considered within the Assessment

Activity	Potential Effect
Climate Change Adaptation and Resilience: Construction Phase	
Construction and demolition activities within the existing airport boundary and construction of upgraded highway junctions	Climate change – extreme weather/climatic events (winds, heatwaves, droughts, intense rainfall events) exacerbating health and safety of construction workers and impacts on nearby sensitive community receptors (CCR and ICCI assessments).
	Climate change – extreme weather/climatic events (winds, heatwaves, droughts, intense rainfall events) exacerbating environmental impact effects 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	Climate change – extreme weather/climatic events (winds, heatwaves, droughts, intense rainfall events) negatively affecting performance of construction equipment/delays to construction programme (CCR assessment).
Climate Change Adaptation and Resilience: Operational Phase	
Performance of the Project with respect to climate change resilience and adaptation.	Climate change - change in seasonal patterns (rainfall and temperatures) affecting soil moisture, flora growing season, green infrastructure (ICCI and CCR assessments).
	Climate change – extreme weather/climatic events (winds, heatwaves, droughts, intense rainfall events) exacerbating environmental impacts to air, land, biodiversity, water, and human health receptors (ICCI assessment).
	Climate change - change in seasonal patterns (rainfall and temperatures) affecting health and safety (CCR assessment).

Activity	Potential Effect
	Climate change - High temperatures, heatwave, high intensity rainfall events, snowfall 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	Climate change - change in seasonal patterns (rainfall and temperatures) affecting soil moisture, flora growing season, green infrastructure (ICCI assessment).
	Climate change – extreme weather/climatic events (winds, heatwaves, droughts, intense rainfall events) exacerbating environmental impacts to air, land, biodiversity, water, and human health receptors (ICCI assessment).
GHG Emissions Assessment: Construction Phase	
GHG emissions arising from construction and demolition activities within the existing airport boundary, and construction of upgraded highway junctions and any other buildings/infrastructure outside the airport boundary included in the Project description	GHGs arising from the extraction, processing and manufacturing of construction materials.
	GHGs arising from transportation of materials from factory to site.
	GHGs arising from energy use in construction activities (ie operation of plant etc.).
	GHGs arising from transport and disposal of construction and demolition waste.
	GHGs arising from surface access for construction staff arising from the Project.
GHG emissions arising from Land use change	Loss of carbon sink from soil organic carbon and changes arising from removal/addition of ground vegetation.
GHG Emissions Assessment: Operational Phase	
GHG emissions arising from air transport	GHGs arise from aircraft in the LTO phases for: <ul style="list-style-type: none"> ▪ flights departing Gatwick: taxi-out; take-off roll; initial climb; climb-out (to 915 m⁶); and ▪ flights arriving to Gatwick: approach (from 915 m); landing roll; reverse thrust; taxi-in.
	GHGs arising from departing flights in CCD phase.
GHG emissions arising from surface access journeys from employees, passengers, and freight	GHGs arising from passenger surface access (rail, road).
	GHGs arising from staff surface access (rail, road).
	GHGs arising from freight surface access (rail, road).
GHG emissions arising from the use of airport, buildings and facilities	GHGs arising from energy (fuel, electricity) use for airport buildings, GSE, APUs, GPU, and FEGP.
	GHGs arising from firefighting activities.
	GHGs arising from aircraft engine testing.
	GHGs arising from supply of potable water.
	GHGs arising from pumping and treatment of wastewater.

⁶ 3,000 ft

Activity	Potential Effect
	GHGs arising from waste treatment and disposal.
	GHGs arising from other use of aviation fuels within the airport boundary not listed above (eg helicopter usage).

- 15.4.4 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 Appendix 15.4.2.
- 15.4.5 For the ICCI assessment, a list of the topics and receptors scoped in can be found in Appendix 15.4.2. The ICCI assessment has been deemed as not relevant to Major Accidents and Disasters because a consideration of climate change is included as part of the natural hazards assessment.
- 15.4.6 Effects which are not considered likely to be significant have been scoped out of the assessment. For the CCRA, effects of sea level rise have been scoped out due to the inland location of Gatwick Airport, which means it is not at risk of coastal flooding. In its scoping opinion, PINS has agreed to sea-level rise being scoped out of the assessment (Planning Inspectorate, 2019).
- 15.4.7 For the assessment of GHG emissions, no effects have been scoped out of the assessment. The assessment focuses on GHGs as set out in the Kyoto Protocol, and the resultant international commitments and UK legislation, and considers emissions in terms of CO_{2e}, except for aviation emissions which consider both CO₂ (in line with wider practice and national reporting conventions on aviation) and CO_{2e} where relevant to reporting against targets⁷. The issue of Radiative Forcing (RF) and non-CO₂ impacts from aviation are recognised in corporate reporting guidance in the UK and are referenced within the CCCs Sixth Carbon Budget and in the recent Jet Zero consultation document. However, the supporting information for these documents notes that while a multiplier can be used to provide a short-term estimate of their impact, this does not reflect the actual long-term impact of these emissions – which are not directly analogous to CO₂ impacts. There is no well-established methodology for quantifying non-CO₂ emissions impacts, and uncertainty on the magnitude of their impact, and providing a comparative set of figures alongside the CO₂ emissions would be incompatible with an assessment against national CO₂ targets. This assessment, therefore, does not attempt to quantify non-GHG and RF effects of emissions at altitude, although the likelihood of these contributing to changes in climate are acknowledged. It is likely, however, that many of the measures to improve aircraft efficiencies, to make use of sustainable aviation fuels, and to transition to zero emissions flight, will have a positive impact on non-CO₂ impacts. The consideration of non-CO₂ emissions impacts, and how these are assessed and reflected in wider policy development and climate change strategy, will be kept under review in the preparation of the ES.
- 15.4.8 There is currently no internationally agreed way of allocating international aviation CO₂ emissions to individual countries. However, the United Nations Framework Convention on Climate Change (UNFCCC) provides a recommended approach, which is to allocate aviation emissions to the country of departure. The UK emissions inventory does not include international aviation emissions in the emissions total for the UK, although they are included as an additional

⁷ GHG emissions from aviation fuel are predominantly CO₂ emissions. Converting CO₂ emissions to CO_{2e} emissions for aviation fuel increases the overall value by approximately 1%, most of which is due to emissions of N₂O.

memorandum item (in line with international reporting protocols for the EU and under the UNFCCC).

15.4.9 Guidance is provided by the Civil Aviation Authority (CAA) for the regulatory process for changing airspace design (CAA, 2018a) which recommends inclusion of both arriving and departing aircraft in all flight phases where there would be an airspace change. However, this chapter of the PEIR is assessing the Project without inclusion of airspace design change (which would be considered under a different regulatory regime, if required). The approach adopted in the PEIR has been to quantify the emissions associated with outward flights only. This effectively allocates emissions to the departing airport location and avoids double counting at a national and international level. For LTO emissions the relevant GHG emissions are those for take-off from Gatwick and landing at another airport. For the purposes of the assessment (and in the absence of data on other airports) the assumption is that landing emissions from inbound flights at Gatwick are equal and equivalent to the landing emissions for outbound flights at destination airports. The Air Quality assessment has assessed LTO emissions in the vicinity of Gatwick (landing emissions for inbound flights, and take-off emissions for outbound flights) and the total of these is assumed to be equal and equivalent to the sum of take-off emissions at Gatwick and landing emissions at destination airports for all outbound flights. In this way total outbound LTO emissions can be estimated. Outbound CCD emissions have then been calculated separately and added to LTO emissions to provide the total outbound GHG emissions. This approach provides consistency with national reporting in that domestic flight emissions are attributable to the origin airport location, and that international flights are attributable to the origin country. It also aligns with the UK emissions inventory approach which quantifies domestic aviation emissions, and accounts for emissions associated with international bunker fuel sales (ie fuel purchased for outward international flights).

15.4.10 In summary, the quantification includes or excludes the aviation emissions sources shown in Table 15.4.3.

Table 15.4.3: Aviation Emissions Sources for GHG Assessment

	Outward flights			Inward flights		
	Taxi out and take-off from Gatwick Airport	CCD aloft	Landing and taxi in at other airport	Taxi out and take-off from other airport	CCD aloft	Landing and taxi in at Gatwick Airport
Domestic flights	Included	Included	Excluded	Excluded	Excluded	Included
International flights	Included	Included	Excluded	Excluded	Excluded	Included

15.4.11 The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (WBCSD/WRI, 2015) defines three ‘scopes’ of emissions that are used for corporate reporting. Broadly these scopes can be summarised as follows.

- **Scope 1:** direct emissions of GHGs from plant, equipment, vehicles owned by the reporting corporate entity (eg combustion of natural gas, vehicle fuels, and emissions of refrigerants).

- **Scope 2:** indirect emissions of GHGs associated with purchased electricity, steam, heating and cooling (purchased by the reporting corporate entity).
- **Scope 3:** other GHG emissions arising from the activities of the organisation including those associated with construction, transportation and distribution, waste, water, business travel, employee commuting.

15.4.12 Reporting the emissions for the Project against these scopes is complex (and of limited value for this PEIR) as the GHG Protocol is intended as guidance for corporate reporting, and the Project incorporates emissions from multiple corporate entities. As an example, the use of aviation fuel for a flight is a Scope 1 emission for the operating airline but would be classed as a Scope 3 emission for Gatwick Airport Ltd (were they to report it). For this reason, limited reference is made to which emissions fall under Scopes 1/2/3, but where this reference is made it is from the perspective of the most relevant corporate reporting entity, Gatwick Airport Ltd.

Study Area

- 15.4.13 The study area for the CCR assessment is the Project site boundary and upgraded highway junctions. The construction assessment also includes any areas of land required temporarily for construction. Figure 1.3.1 of the PEIR shows the Project site boundary including the highways works.
- 15.4.14 The study area for the ICCI corresponds to the study area boundaries defined for each of the environmental topics considered in the EIA process (refer to relevant chapters of this PEIR, from Chapter 7 to Chapter 18).
- 15.4.15 The study area for the GHG assessment considers the emissions of GHG arising from the construction and operation of the Project, some of which are emitted within the site boundary, but the majority of which are emitted outside of the boundary. This covers both construction and operational emissions as summarised in the list below.
- For construction emissions, the physical scope extends to the extraction and sourcing of materials nationally and internationally, as well as construction processes within the Project site boundary. Transportation of waste, and transport of workers to the Project also take place outside the Project site boundary.
 - For the operational phase, emissions arise from the energy, waste arisings and water consumed within the Project site boundary. However, many of the upstream emissions associated with these (eg energy for electricity generation and potable water treatment) are outside the physical boundary of the Project site.
 - Emissions from aviation and from surface access during operation also arise primarily outside the physical boundary of the Project site.

Temporal Scope

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

- 15.4.17 Construction works are planned to commence in 2024 and activities will be phased over a period of 14 years. The 2020-2049 (2030's) time period (see paragraph 15.4.19 below) is used for construction activities for both the ICCI and CCR assessments to represent a reasonable worst-case approach.
- 15.4.18 For receptors or assets that are in place in perpetuity, the end of the 21st 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 phases of the Project) are not relevant to the assessment. Instead, the assessment has used a later period, the 2050-2079 (2060's), 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 ICCI and CCR assessments, are not available in UKCP18 beyond 2079. The limitations of the ICCI and CCR assessments are described in Section 15.5.

Methodology for Baseline Studies

Desk Study

Climate Change Adaptation and Resilience

- 15.4.19 Information regarding current and projected future climate conditions has been used in the ICCI and CCR assessments. Three sets of climate data have been assembled:
- current climate conditions – based on observed weather observations;
 - future climate scenario for 2020-2049 ('2030s'); and
 - future climate scenario for 2050-2079 ('2060s').
- 15.4.20 These climate data sets are based on the Met Office's UKCP18, 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 observed historical climate observations. These data are described in more detail in Section 15.6 of this chapter.
- 15.4.21 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 phase of the Project for the receptors and assets assessed in the ICCI and CCR assessments.
- 15.4.22 The CCR assessment does not have a baseline as such, as it relates only to the new development. The CCR assessment is however 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; GAL, 2016).

GHG Emissions Assessment

- 15.4.23 The general approach to estimating GHGs for the Project has been to adopt a worst-case assessment of emissions so as to avoid under-estimation of impact. The approach has been to quantify GHG emissions based on the generalised formula combining:
- **activity data** – a measure of the quantity of an activity; and
 - **GHG factor** – a measure of the GHG emissions per unit of activity.

- 15.4.24 Activity data depend on the specific activity being assessed and the way they are quantified, eg:
- fuel consumption is typically quantified in litres or tonnes;
 - energy consumption is typically quantified in kWh;
 - transport activity is typically measured in vehicle.km or passenger.km; and
 - construction materials and waste are quantified in m³ or tonnes.
- 15.4.25 GHG factors are drawn from national and international sources. Where these factors are expected to change over the duration of the Project then a time-based factor is used, based on understanding the extent and rate at which the factor would increase or reduce.
- 15.4.26 The baseline year is the calendar year 2018⁸. Baseline activity data reflect actual usage and consumption in the calendar year 2018 as recorded by Gatwick Airport or other parties. Data have been collected from several sources including corporate reporting (GAL, 2018), historic flight records from Gatwick Airport, and UK CAA travel surveys. For some activities (eg operation of buildings not owned/managed by GAL) it has been necessary to seek data from those third-party operators. A conservative approach has been taken in all such cases to avoid as far as possible under-estimation of GHG emissions.
- 15.4.27 In the absence of actual consumption data for specific activities it has been necessary to draw on benchmark information to understand typical operations. A full list of data sources is set out in Appendix 15.4.1. A conservative approach has been taken in all such cases to avoid as far as possible under-estimation of GHG emissions.
- 15.4.28 The future baseline GHG emissions (in the absence of the Project) are based on developing forecasts of activity data. In many cases these are developed by scaling the 2018 baseline activity data linearly using forecasts of passenger numbers.
- 15.4.29 The future baseline accounts for expected changes to GHG factors for key activities – namely the decarbonisation of the national electricity grid, and improvements to the efficiency of road vehicles. The future baseline also considers other national scale changes affecting emissions, most notably the expected change in road vehicle usage away from fossil fuels and to electric vehicles. The projected emissions from aviation include for the change of fleet over time to aircraft with increased engine efficiency. However, the projected emissions do not include any consideration of SAF within the operation of aircraft, or other improvements such as uptake of electrical or hydrogen powered aircraft, which are expected to be in operation over the timeframe of the project for some domestic and short haul flights.
- 15.4.30 The key future baseline emissions have been forecast as follows:
- future baseline construction emissions will incorporate planned construction projects which are already consented and are expected to be carried out in the absence of the Project;
 - air traffic movements⁹ (ATMs) are forecast to increase in the absence of the Project, and these increases are included in the future baseline;
 - energy and water use, waste generation and wastewater production, will increase at the airport due to increased passenger numbers in the absence of the Project; and

⁸ 2018 is being used for the GHG assessment to align with other topics assessed using similar modelling years and outputs, most pertinently Air Quality assessment work developed on the 2018 road traffic information.

⁹ For the purposes of this chapter 'Air Traffic Movements' or ATMs refers to commercial air traffic movements and other aircraft movements (such as business aviation and occasional positioning flights). Hereinafter for the purpose of this chapter all references to ATMs include all such aircraft movements.

- surface access for passengers, staff and freight will also increase in the absence of the Project, and the emissions arising from these are included in the future baseline.

15.4.31 The scaling approach for baseline emissions sources is set out in Table 15.4.4.

Table 15.4.4: Scaling Approach for Future Baseline Assessment

Emissions Source	Scaling Methodology for Future Baseline
Construction Phase (including Demolition)	
GHGs arising from the extraction, processing and manufacturing of construction materials	Future baseline emissions from construction are based on planned construction in the absence of the Project, which will include an extension to Pier 6, construction of two multi-storey car parks, and the extension to South Terminal International Departures. Based on project parameters and building footprints, estimates of construction materials have been developed using typical building benchmarks. These have then been used to estimate construction plant energy and other emissions associated with construction activities.
GHGs arising from transportation of materials from factory to site	
GHGs arising from energy use in construction activities (eg operation of plant etc.)	
GHGs arising from transport and disposal of construction and demolition waste	
GHGs arising from surface access for construction staff arising from the Project	
Loss of carbon sink from soil organic carbon and changes arising from removal/addition of ground vegetation	
Operational Phase	
GHGs arising from aircraft in the Landing LTO phases for: Flights departing Gatwick: taxi-out; take-off roll; initial climb; climb-out (to 915 metres); and Flights arriving to Gatwick: approach (from 915 metres); landing roll; reverse thrust; taxi-in.	Future baseline emissions from aviation have not been linearly scaled. They are based on forecast future ATMs in the absence of the Project. Forecasting of future ATMs includes consideration of the aircraft in use for different flights with modelling of LTO and CCD emissions then based on these forecast flight/aircraft numbers.
GHGs arising from departing flights in CCD phase	The future baseline has been developed by scaling 2018 surface access emissions by forecast passenger numbers in the absence of the Project.
GHGs arising from passenger surface access (rail, road)	
GHGs arising from staff surface access (rail, road)	The future baseline has been developed by scaling 2018 estimated freight transport by the forecast increases in cargo freight tonnage in the absence of the Project. The future baseline does not yet include retail freight although this will be included in the final ES.
GHGs arising from freight surface access (rail, road)	
GHGs arising from energy (fuel, electricity) use for airport buildings, GSE, APUs, GPU, and FEGP	Future baseline emissions from operational energy have not been linearly scaled. The future baseline in the absence of the Project has been produced as part of the preliminary energy strategy development for the airport that takes into

Emissions Source	Scaling Methodology for Future Baseline
	account expected changes in building regulations, improvements to the existing estate performance, changes in energy supply strategy, and decarbonisation of the electricity grid.
GHGs arising from firefighting activities	The future baseline emissions from firefighting activities within the fire training ground were developed as part of the air quality assessment and reference should be made to the methodology in Chapter 13: Air Quality.
GHGs arising from aircraft engine testing	The future baseline emissions from aircraft engine testing activities were developed as part of the air quality assessment and reference should be made to the methodology in Chapter 13: Air Quality.
GHGs arising from supply of potable water	The future baseline has been developed by scaling 2018 water supply emissions by forecast passenger numbers in the absence of the Project.
GHGs arising from pumping and treatment of wastewater	The future baseline has been developed by scaling 2018 wastewater emissions by forecast passenger numbers in the absence of the Project.
GHGs arising from waste treatment and disposal	The future baseline has been developed by scaling 2018 waste management emissions by forecast passenger numbers in the absence of the Project.
GHGs arising from other use of aviation fuels within the airport boundary not listed above (eg helicopter usage).	The future baseline emissions from other aviation fuel use was developed as part of the air quality assessment and reference should be made to the methodology in Chapter 13: Air Quality.

Site-Specific Surveys

- 15.4.32 No site-specific surveys have been, or will be, conducted for the CCR, ICCI and GHG assessments.

Assessment Criteria and Assignment of Significance

Climate Change Resilience

- 15.4.33 The CCR assessment considers the resilience of the Project to the physical impacts of climate change.
- 15.4.34 IEMA guidance defines climate change resilience 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*'.
- 15.4.35 The CCR assessment differs from many other EIA topics in that it considers how the resilience of a development is affected by an external factor (climate change) not how environmental receptors

are 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 has been used for the CCR assessment.

15.4.36 The risk assessment uses a combination of likelihood of climate impacts occurring and the potential consequence of those impacts to determine risk according to a five-point scale: very low, low, medium, high or very high. Any impacts determined to be high or very high risk have been identified as requiring mitigation. For the purposes of the CCR, the 2060s Future Climate Scenario (paragraph 15.4.19) has been used.

15.4.37 The methodology for the CCR risk assessment is as follows:

- 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 15.4.5.
 - 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;
 - existing or 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 15.4.6; and
- determine the risk level based on a combination of likelihood and consequence based on the risk matrix given in Table 15.4.7.

Table 15.4.5: Criteria to Assess Likelihood of Climate Change Impact

Level of Likelihood	Definition of Likelihood
Very unlikely	It is highly improbable that the impact will occur during the operational phase of the assets or systems or the construction phase.
Unlikely	Impact is not expected to occur during the operational phase of the assets or systems or the construction phase.
As likely as not	Impact may occur during the operational phases of the assets or systems or the construction phase.
Likely	Impact is expected to occur during the lifespan of the assets or systems or the construction phase.
Very likely	It is highly probable that the impact will occur during the lifetime of assets or systems or the construction phase.

Table 15.4.6: Criteria Used to Assess Consequence of a Climate Change Impact

Consequence Rating	Disruption	Public perception	Financial	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.
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 Environment Agency.	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

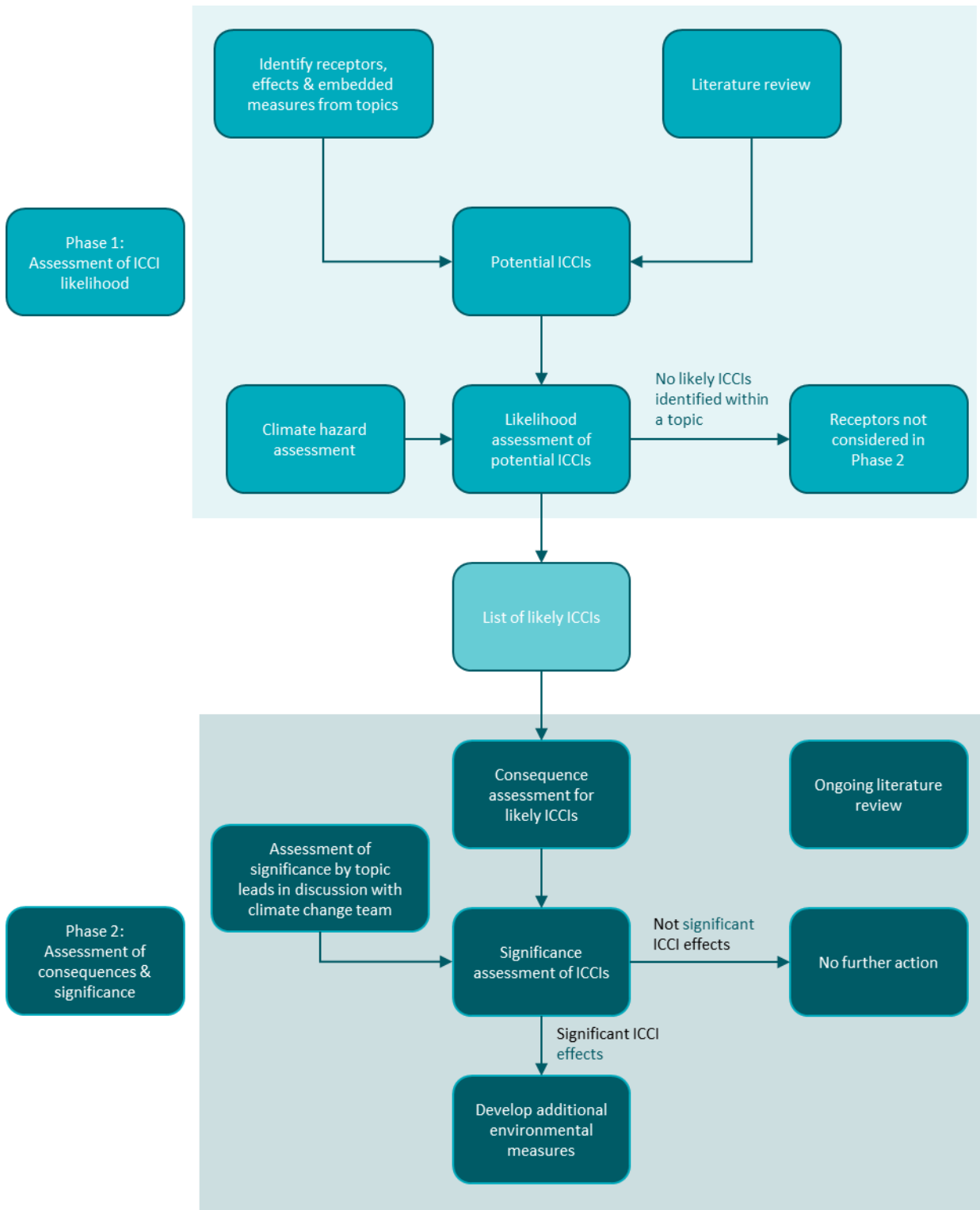
Table 15.4.7: Risk Levels as a function of combined likelihood and consequence

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

In-combination Climate Change Impacts

- 15.4.38 The ICCI assessment assesses the extent to which climate change exacerbates an effect on an environmental receptor listed in Table 15.4.3 in Appendix 15.4.2.
- 15.4.39 The ICCI assessment methodology has been developed in line with the Institute of Environmental Management and Assessment (IEMA) – ‘Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation’ (IEMA, 2020).
- 15.4.40 Key terminology used within the ICCI assessment is presented in Appendix 15.4.2. The ICCI assessment follows the same approach to assessing impacts and determining significance as for each of the PEIR topics, but with the added consideration of future climate change projections. The methodology for the ICCI assessment is described in Diagram 15.4.1.

Diagram 15.4.1 Methodology for ICCI assessment



Phase 1 Assessment of In-combination Climate Change Impact Likelihood

- 15.4.41 Phase 1 aims to screen out any ICCIs that are considered too unlikely to occur, eg climate change hazard does not influence the impact identified by the topic, and therefore do not require further assessment.
- 15.4.42 It considers the effects already identified by environmental topics based upon their own impact assessment methodologies. It also identifies any embedded environmental measures proposed by the environmental discipline and the engineering and design teams.
- 15.4.43 A list of potential ICCIs was collated based on:
- the initial assessment from the other PEIR disciplines 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.
- 15.4.44 The likelihood of each potential ICCI occurring was assessed using expert judgement based on two factors.
- The likelihood of the climate impact occurring, based on the climate hazard assessment.
 - The likelihood of the climate impact changing an effect already identified by another PEIR discipline. This assessment was based on the literature review and expert judgement of the climate and environmental specialists. In assessing likelihood, the embedded environmental measures were also considered.
- 15.4.45 Due 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.

Phase 2 Assessment of Consequence and Significance

- 15.4.46 Phase 2 assessed the consequence of the likely ICCIs identified in Phase 1, thus enabling a determination of significance for each.
- 15.4.47 The assessment of significance was completed by the climate change specialist and environmental specialist from the relevant disciplines working together to provide a qualitative assessment of consequence and therefore significance of the ICCI.
- 15.4.48 The PEIR disciplines 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 against the significance criteria used by the discipline due to climate change (eg an increase in consequence of effect or an increase in scale of change); and/or
 - an existing significant effect is exacerbated against the significance criteria used by the discipline due to climate change (eg a further increase in the consequence of effect or a further increase in scale of change).

- 15.4.49 If an effect was not previously significant and any exacerbation by climate change does not change this, the ICCI effect is not significant.
- 15.4.50 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 environmental measures have been included within the assessments of significance.
- 15.4.51 The exception to this approach is the assessment for flood risk and drainage design. A separate FRA (Appendix 11.9.1) is being carried out, which is quantitative and follows current Environmental Agency guidance on climate change allowances for all forms of flood risk.

GHG Emissions Assessment

- 15.4.52 Guidance on assessing the significance of GHG emissions is set out in a number of documents:
- Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2017).
 - Airports NPS: new runway capacity and infrastructure at airports in the South East of England (Department for Transport, 2018a).
 - Airports NPS – Appraisal of Sustainability (Department for Transport, 2018c).
- 15.4.53 In line with IEMA guidance (IEMA, 2017) all GHG emissions are considered significant due to the permanent, cumulative nature of GHG emissions. However, this guidance also sets out the requirement to provide context for the emissions quantification (in terms of relevant sectoral, local or national carbon budgets) and to provide information on carbon mitigation measures.
- 15.4.54 In May 2019 the CCC recommended that the UK should set and pursue a net-zero GHG target to respond to the latest climate science and fully meet the UK's obligations under the Paris Agreement. The UK Government responded by introducing a Statutory Instrument (June 2019) that changed the Climate Change Act 2008 target from an 80 per cent reduction against a 1990 baseline to a 100 per cent reduction (net-zero). The Sixth Carbon Budget was the first to reflect the change in the long-term carbon target for 2050.
- 15.4.55 The Climate Change Act 2008 sets the target for UK emissions for 2050, and carbon budgets have been developed by the CCC for four-year periods from 2008, and most recently for 2033-2037 (the Sixth Carbon Budget). This is set at 965 megatonnes¹⁰ of carbon dioxide equivalent (MtCO_{2e}) for 2033-2037, and for the first time this budget includes emissions from international shipping and international aviation.
- 15.4.56 As noted in the summary of the Airports NPS, one measure of significance of emissions is based on whether they materially impact on the ability of Government to meet carbon reduction targets.
- 15.4.57 The Appraisal of Sustainability for the Airports NPS is based on an appropriate planning assumption for CO₂ emissions from domestic and international aviation in 2050 of 37.5 MtCO₂, as recommended by the CCC. Reporting of aviation emissions in units of CO₂ (rather than CO_{2e} as for other emissions) is in line with guidance from the CCC.

¹⁰ A megatonne (Mt) is equivalent to 1,000,000 metric tonnes

- 15.4.58 The Sixth Carbon Budget (CCC, 2020) does not provide a budget recommendation for aviation but does set out a range of scenarios for future aviation which adopt different modelling assumptions on aviation growth, engine efficiencies, and use of alternative fuels. Outturn emissions from aviation in 2050 vary widely across these scenarios¹¹. The PEIR does not fully explore the range of potential scenarios out to 2050, and the relative impacts of different measures to decarbonise aircraft emissions. These will be further explored in the ES in view of the Jet Zero consultation and the next steps arising from it.
- 15.4.59 Emissions calculations within this PEIR have been quantified in line with the Airports NPS guidance/categorisation. Following this guidance, the emissions are quantified as domestic or international, and categorised as traded or non-traded emissions (under the UK ETS).
- 15.4.60 A conservative approach has been taken through the GHG assessment to avoid under-estimating impact, and the quantification of GHG emissions represents a reasonable worst-case assessment. The quantification does not reflect fully the potential decarbonisation mechanisms included in current consultation on achieving Net Zero in the aviation sector. Given that all GHG emissions are considered significant in this assessment (in line with IEMA guidance) the predicted effect has been quantified and put into context against the future baseline scenario, and against national carbon budgets.

15.5. Assumptions and Limitations of the Assessment

Climate Change Resilience and In-combination Climate Change Impacts Assessments

- 15.5.1 All climate change projections are subject to uncertainties, due to the complexity of the climate system, natural climate variability, uncertainty over future greenhouse gas emission levels and modelling uncertainties.
- 15.5.2 In order to address uncertainty in model projections, UKCP18 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 these data only go up to 2079.
- 15.5.3 Information on climate change effects on lightning and fog is not currently available in UKCP18 (Met Office, 2018a). The information available from UKCP09 (Met Office, 2009) has therefore been used in this PEIR. If updated information on projections of parameters for lightning and fog become available at a later date, these will be considered in the ES.
- 15.5.4 Assessments made in relation to ‘consequence’ and ‘likelihood’ have relied on professional judgement and evidence gathered through other environmental discipline assessments. Initial environmental mitigation measures have been presented in the assessment below. These mitigation measures will continue to be developed further, and will be described in more detail in

¹¹ The Jet Zero consultation also includes a range of potential emissions scenarios for aviation which represent additional modelling from UK Government, and which include potential trajectories reflecting technology improvements and SAF uptake.

the ES. This does not affect the robustness of the PEIR assessment, and the mandatory requirements for the assessment in the PEIR have been met.

- 15.5.5 All existing assets are assumed to be maintained in line with Gatwick’s existing Climate Change Adaptation Report (GAL, 2016) and therefore are not assessed here. This report assesses future impacts for new assets only.

GHG Emissions Assessment

- 15.5.6 The temporal scope of this assessment extends to 2050, and this means that assumptions have been made for activities occurring over the period from baseline (2018) to 2050. These assumptions include emissions factors for the range of GHG emitting activities.
- 15.5.7 Most future emission factors will be dependent on factors outside of Gatwick’s control, for example those affected through UK Government policy and legislation (as set out in Section 15.2). This means that there are inherent uncertainties in the quantification of future GHG emissions.
- 15.5.8 Table 15.5.1 sets out the main assumptions that have informed the development of the future scenario GHG estimates. Additional details on assumptions within the modelling process are set out in Appendix 15.4.1.

Table 15.5.1: Assumptions within the GHG Assessment

Assessment Issue	Assumptions
Future decarbonisation of the UK national grid	The grid is forecast to reduce in carbon intensity over the period of the Project, meaning that the GHG emissions from electricity use will reduce per kilowatt hour (kWh). The extent and rate at which this will happen is unclear. The assessment has used UK Government forecasts for grid decarbonisation set out in the Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal (BEIS, 2020a). This decarbonisation trajectory is set out in Appendix 15.4.1.
Changes to the road vehicle fleet	The road vehicle fleet in the UK is projected to change in terms of the efficiency of vehicles, and also the shift from use of petrol/diesel vehicles to increasing numbers of electric vehicles. The assumed changes in vehicle fleet make-up are presented in Appendix 15.4.1.
Aviation emissions	The assumptions informing fuel use for aircraft in operation until 2038 are as set out in the air quality assessment in Chapter 13 ¹² . The assessment includes a projection for emissions in the year 2050 based on a small amount of modelled growth between 2039 and 2050. The assessment is cognisant of factors which will affect the efficiency of aircraft in future and assumes industry-wide year-on-year efficiency improvements of 1.4 per cent in line with the CCC ‘Balanced Net Zero Pathway’ from the 2020 Sixth Carbon Budget (CCC, 2020) for the period 2038-

¹² The assessment out to 2038 has been based on estimates of how the aircraft fleet will transition over time, based on assumptions around airlines’ fleet procurement programmes and business models. The ‘central case’ used in this assessment is based on what is considered today to be the most likely rate of fleet transition. Any implications of a slower transition fleet in this period will be reviewed for the ES.

Assessment Issue	Assumptions
	<p>2050 only. This is provided alongside the forecast emissions without this efficiency assumption to illustrate the scale of such measures.</p> <p>The assessment does not take any account of the uptake of alternative-fuelled aircraft (such as hydrogen, electric, or hybrid aircraft) which are expected to be introduced over time for some domestic and short haul flights.</p> <p>The projected emissions under all scenarios (2018 to 2050) do not include any allowance for use of SAF although these are expected to be in increasing use as part of the sectoral transition to net zero GHG emissions.</p> <p>This is considered to be a conservative approach, and the applicability of different assumptions on future decarbonisation mechanisms will be revisited in the ES.</p>
Sustainable Aviation Fuels (SAF)	<p>The assessment in this PEIR does not consider the use of SAF in any modelled scenarios and as such contributes to a worst-case quantification of aviation emissions in the assessment years. Use of SAF is expected to be a significant element within wider decarbonisation of the aviation sector and will be more fully explored in the ES.</p>
Zero emissions flight technology	<p>The assessment in this PEIR does not consider the development and use of electrical or hydrogen powered aircraft, which are expected to be in operation over the timeframe of the project for some domestic and short haul flights.</p>
Construction materials	<p>In the absence of detailed design quantities for construction projects (which would be developed later) benchmarks for typical materials per m² of floor area of building have been used. Further details on these assumptions are set out in Appendix 15.4.1.</p> <p>For this PEIR no assumptions have been made regarding changes to the embodied carbon of construction materials in future years. As the UK progresses towards climate change targets for 2050 these are expected to reduce. This is considered a conservative approach to estimating embodied carbon emissions for construction. A fuller understanding of the construction materials for the Project would be developed, and as part of this an allowance for future embodied carbon reductions will be incorporated for the final ES.</p>
Construction material and waste transportation	<p>Construction waste arises from two main sources: the demolition or removal of existing structures/surfaces, and waste generation from onsite construction activities. In the absence of detailed design quantities benchmarks for typical waste quantities have been used.</p> <p>For this PEIR the estimates of demolition/removal of existing structures/surface assumes no reuse of materials within the Project (although this can be considered a worst case approach to the assessment – further development of the mitigation strategy is likely to lead to some of these emissions being avoided and this will be reported in the ES).</p> <p>Construction waste production from construction processes will be estimates as an additional % tonnage overhead on the construction materials. Further details on these assumptions are set out in Appendix 15.4.1.</p>

Assessment Issue	Assumptions
Construction processes	<p>Construction process emissions arise from the operation of plant and equipment on site. This ranges from large scale plant (eg batching plant for concrete) to operation of individual pieces of machinery. Emissions arise from the energy use which can be powered by a range of sources including grid electricity, local electricity generation, or direct fuel use.</p> <p>Construction emissions have been estimated based on staff numbers for plant operatives, assuming a set number of operating hours per operator and using benchmark energy consumption for a set of indicative plant equipment.</p> <p>For this PEIR no assumptions have been made regarding changes to the carbon intensity of power/fuels used in construction plant. As the UK progresses towards climate change targets for 2050 these are expected to reduce. A fuller understanding of the construction processes and plant usage for the Project will be developed, and as part of this an allowance for future changes to construction plant power/fuel emissions will be incorporated for the final ES.</p>
Surface access for passengers	<p>The quantification of future emissions from surface access has been developed from the 2018 baseline, scaled to reflect changes in passenger numbers but ultimately not reflecting any significant modal shift, and as such is considered a conservative approach. Assumptions have been made on the likely transition to lower emissions vehicles over time. Further details on these assumptions are set out in Appendix 15.4.1.</p>
Surface access for airport staff/workers	<p>The quantification of future emissions from staff travel to/from the airport has been developed from the 2018 baseline, scaled to reflect changes in ATMs, but ultimately not reflecting any significant modal shift, and as such is considered a conservative approach. Assumptions have been made on the likely transition to lower emissions vehicles over time. Further details on these assumptions are set out in Appendix 15.4.1.</p>
Freight transport	<p>Detailed data are unavailable at present on freight transport which comprises several categories of vehicle transport:</p> <ul style="list-style-type: none"> ▪ freight supporting retail activities; ▪ airline serving freight; ▪ airport service freight; and ▪ cargo/mail freight. <p>Forecasts for the Project provide estimates of cargo/mail freight and at this stage emissions for this component only have been calculated. Other freight (including retail freight) will be included in the final ES. It is currently estimated that non-cargo freight emissions will be approximately equivalent to the calculated cargo freight emissions.</p>
Airport operations	<p>Airport operations incorporates several emissions activities including operational energy use, aviation fuel for firefighting and aircraft engine testing, and water/wastewater/waste emissions.</p> <p>Emissions from the use of aviation fuel (firefighting, engine testing, APUs, other non-aviation uses) have been calculated as set out in the air quality assessment in Chapter 13. Further details on other emissions activities assumptions are set out in Appendix 15.4.1.</p>

15.6. Baseline Environment

Current Baseline Conditions

Climate Change Resilience and In-combination Climate Change Impacts Assessments

- 15.6.1 Information regarding historical climate conditions at Gatwick Airport was obtained from the UKCP18 observed climate data sets. All the data for the current baseline were obtained from this source.
- 15.6.2 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 is presented in Figure 15.6.1 and the 25 km × 25 km grid resolution is presented in Figure 15.6.2.
- 15.6.3 Seasonal climate averages for Gatwick Airport are given in Table 15.6.1. Information regarding occurrence of extreme weather events, including hot days, frost days, heavy rainfall and dry spells is given in Table 15.6.2. The data are presented as the average increase in number of days per year.
- 15.6.4 This data was derived by analysis of observed weather timeseries from gridded datasets. The data 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.
- 15.6.5 Gatwick is one of three sites in and around London for which design weather data are provided by the CIBSE (2014). This guidance document indicates that Gatwick Airport does not experience a detectable urban heat island effect and the airport has a climate that is characteristic of its rural surroundings.

Table 15.6.1: 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

Table 15.6.2: Historical Extreme Weather Events for the Gatwick Area

Parameter	Baseline 1981-2010
Number of frost days (daily minimum temperature equal or lower than 0°C)	53.6
Heatwaves (two days with maximum temperature higher than 29°C and minimum temperature higher than 15°C)	0.3
Number of hot days (daily maximum temperature higher than 25°C)	17.3
Dry spells (10 days or more with no precipitation)	4.9
Number of days per year when precipitation is greater than 25 mm per day (Met Office definition of 'heavy rain')	1.9
Relative humidity winter (%)	85.7
Relative humidity summer (%)	77.3

GHG Emissions Assessment

15.6.6 The baseline refers to Gatwick’s GHG emissions in the calendar year 2018. It draws together information from a range of documents, analyses and sources. A full breakdown of emissions is included in Appendix 15.4.1 to provide estimates of GHG emissions, these are summarised in Table 15.6.3 to Table 15.6.5¹³.

Table 15.6.3: 2018 Baseline: Construction, Airport Operation, Surface Access

Emissions Activity	GHG Emissions (MtCO ₂ e)
	2018
Construction	
Construction	Baseline construction emissions for 2018 are considered to be zero for the purposes of the assessment.
Land use change	Land use change emissions (eg from addition/removal of vegetated areas) have not been calculated for this PEIR. These will be incorporated into the final ES. It is not expected that emissions from land use change will materially affect the assessment in this PEIR and its conclusions.
Operation	
Airport operation	0.081
Surface access	0.308

¹³ Emissions activities are marked with an alphanumeric superscript to aid in reconciliation with reported totals in subsequent tables.

Table 15.6.4: 2018 Baseline: Aircraft Emissions

Emissions Activity	GHG Emissions (MtCO ₂)
	2018
UK domestic flights	
LTO	0.027
CCD	0.050
Total	0.077
Non-domestic EEA flights	
LTO	0.225
CCD	1.346
Total	1.571
Non-EEA International flights	
LTO	0.146
CCD	2.927
Total	3.073

Table 15.6.5: 2018 Baseline: Summary

Emissions Totals	GHG Emissions (MtCO ₂ e ¹⁴)
	2018
Total excluding international air transport	0.466
Total including international air transport	5.110

15.6.7 Traded sector emissions for 2018 were those which fell under the EU ETS. These include domestic and non-domestic intra-EEU aviation emissions, and also a portion of emissions generated by combustion plant owned and operated by Gatwick Airport Ltd. Emissions under EU ETS consider only CO₂ emissions (not the wider CO₂-equivalent emissions).

Table 15.6.6: 2018 Baseline: Traded Sector Emissions

Emissions Totals	GHG Emissions (MtCO ₂)
	2018
UK domestic flights ^(e)	0.077
Non-domestic EEA flights ^(f)	1.571
Gatwick Airport Ltd UK ETS emissions	0.010
Total traded sector emissions	1.658

¹⁴ Unless explicitly stated all emissions totals are based on CO₂ emissions for aviation aggregated with CO₂e emissions for other activities.

Future Baseline Conditions

Climate Change Resilience and In-combination Climate Change Impacts Assessments

- 15.6.8 Information regarding future climate has been obtained from the UKCP18 projections (Met Office, 2018a). The GHG emissions scenario considered was RCP8.5¹⁵. The Airports NPS 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.
- 15.6.9 Changes in the future values of climate averages were obtained from the probabilistic projections data set on a 25 km × 25 km grid. The nearest grid cell to Gatwick was selected.
- 15.6.10 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 at 2.2 km grid resolution has not been used because the increased resolution does not change the outcome of the assessment and therefore the 12 km grid resolution is considered sufficient.
- 15.6.11 The grid cell selected to collect the future climate data for Gatwick at the two resolutions is presented in Figures 15.6.1 and 15.6.2.
- 15.6.12 Table 15.6.7 and Table 15.6.8 show the predicted values for seasonal averages of temperature, precipitation and relative humidity in the two future climate periods. The data are presented as the average increase in number of days per year. Note that in the calculation, the variables are treated as being independent. The data indicate that mean temperatures will increase, winter precipitation will increase, and summer precipitation will decrease in comparison with baseline temperatures recorded in Table 15.6.1.

Table 15.6.7: UKCP18 Climate Change Projections for Meteorological Changes for the Gatwick Area

Parameter	2020-2049 (RCP8.5 Percentile)		
	10 th	50 th	90 th
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 Representative Concentration Pathway's (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)

Table 15.6.8: UKCP18 Climate Change Projections for Meteorological Changes for the Gatwick Area

Parameter	2050-2079 (RCP8.5 Percentile)		
	10 th	50 th	90 th
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

15.6.13 Table 15.6.9 and Table 15.6.10 contain projections for extreme weather events, including hot days, cold days, heavy rainfall, dry spells and relative humidity. The data are presented as the average increase in number of days per year.

15.6.14 Table 15.6.10 demonstrates that the frequencies of hot days, dry spells and heavy rainfall will all increase in the future compared to the baseline, whilst the number of cold days will decrease. This suggests hot day temperatures (>25°C) and heavy rainfall will pose an increased risk to Gatwick Airport and cold temperatures will pose a decreased risk, and that the need for de-icing is likely to decrease. Whilst winters are expected to become warmer on average, cold weather spells will still occur up to and during the middle of this century and are expected to be the same magnitude and intensity as today.

Table 15.6.9: UKCP18 Projections for Future Extreme Weather Events for the Gatwick Area

Parameter	2020-2049		
	RCP8.5 Min	RCP8.5 Mean	RCP8.5 Max
Number of frost days (daily minimum temperature equal or lower than 0°C)	28.8	37.5	49.4
Heatwaves (two days with maximum temperature higher than 29°C and minimum temperature higher than 15°C)	0.2	1.8	4.9
Number of hot days (daily maximum temperature higher than 25°C)	23.2	37.2	61.6
Dry spells (10 days or more with no precipitation)	4.6	5.4	6.7
Number of days per year when precipitation is greater than 25 mm per day (Met Office definition of 'heavy rain')	1.4	2.4	4.3
Relative humidity winter (%)	85.5	85.5	85.5
Relative humidity summer (%)	73.0	73.0	73.0

Table 15.6.10: UKCP18 Projections for Future Extreme Weather Events for the Gatwick Area

Parameter	2050-2079		
	RCP8.5 Min	RCP8.5 Mean	RCP8.5 Max
Number of frost days (daily minimum temperature equal or lower than 0°C)	20.5	25.2	31.2
Heatwaves (two days with maximum temperature higher than 29°C and minimum temperature higher than 15°C)	2.9	8.0	14.9
Number of hot days (daily maximum temperature higher than 25°C)	43.2	69.0	92.8
Dry spells (10 days or more with no precipitation)	5.4	6.6	7.8
Number of days per year when precipitation is greater than 25 mm per day (Met Office definition of 'heavy rain')	1.6	3.1	4.7
Relative humidity winter (%)	85.1	85.1	85.1
Relative humidity summer (%)	69.0	69.0	69.0

15.6.15 Gatwick has its own Airside Operations Adverse Weather Plan which includes all airside operations areas and details how stable operations are sustained in the event of an adverse weather event.

GHG Emissions Assessment

15.6.16 The future baseline includes the increased passenger numbers and ATMs in the absence of the Project. The full future baseline is set out in Appendix 15.4.1.

Operational Emissions

15.6.17 Future baseline emissions for 2029 and 2038, reflecting the opening year of the Project and design year, are set out in Tables 15.6.11 and 15.6.12 below. The methodology and assumptions included in the calculation of these are set out in Appendix 15.4.1.

Table 15.6.11: Future Baseline: Construction, Airport Operation, Surface Access (Opening/Design Years)

Emissions Activity	Opening Year Emissions (MtCO ₂ e)	Design Year Emissions (MtCO ₂ e)
	2029	2038
Construction		
Construction	No construction is scheduled for the future baseline year 2029.	No construction is scheduled for the future baseline year 2038.
Land use change	Land use change emissions (eg from addition/removal of vegetated areas) have not been calculated for this PEIR. These will be incorporated into the final ES.	
Operation		
Airport operation	0.071	0.061
Surface access	0.368	0.382

15.6.18 Future baseline emissions from aviation are based on:

- recorded flights in 2018; and
- forecast flight details (based on passenger and ATM forecasts) for 2029, 2032 and 2038; further details of the methodology and assumptions are set out in Appendix 15.4.1.

15.6.19 The baseline aircraft emissions are forecast to increase out to 2038, increasing to approximately 321,000 ATMs, leading to higher overall GHG emissions. The projected emissions from aircraft for the future baseline consider the forecast flight destinations and aircraft types. They also reflect changes in the expected aircraft fleet in the period to 2038. The projected emissions do not include any consideration of SAF within the operation of aircraft, or other improvements such as uptake of electrical or hydrogen powered aircraft, which are expected to be in operation over the timeframe of the project for some domestic and short haul flights.

Table 15.6.12: Future Baseline: Aircraft Emissions (Opening/Design years)

Emissions Activity	Opening Year Emissions (MtCO ₂ e)	Design Year Emissions (MtCO ₂ e)
	2029	2038
UK domestic flights		
LTO	0.024	0.023
CCD	0.047	0.045
Total	0.070*	0.068
Non-domestic EEA flights		
LTO	0.244	0.235
CCD	1.510	1.529
Total	1.754	1.764

Emissions Activity	Opening Year Emissions (MtCO ₂ e)	Design Year Emissions (MtCO ₂ e)
	2029	2038
Non-EEA International flights		
LTO	0.159	0.147
CCD	3.575	3.767
Total	3.734	3.914

* Values do not sum due to rounding

15.6.20 A summary of the overall baseline emissions is presented in Table 15.6.13.

Table 15.6.13: Future Baseline: Summary (Opening/Design Years)

Emissions Totals	Opening Year Emissions (MtCO ₂ e)	Design Year Emissions (MtCO ₂ e)
	2029	2038
Total excluding international air transport	0.509	0.511
Total including international air transport	5.997	6.189

15.6.21 The future baseline traded emissions sector emissions are presented in Table 15.6.14 Traded sector emissions are those which fall under the scope of the UK ETS. These include domestic and non-domestic intra-EEU aviation emissions, and also a portion of emissions generated by combustion plant owned and operated by Gatwick Airport Ltd. Emissions under EU ETS consider only CO₂ emissions (not the wider CO₂-equivalent emissions).

Table 15.6.14: Future Baseline: Traded sector emissions (Opening/Design Years)

Emissions Totals	Opening Year GHG Emissions (MtCO ₂)	Design Year GHG Emissions (MtCO ₂)
	2029	2038
UK domestic flights ^(e)	0.070	0.068
Non-domestic EEA flights ^(f)	1.754	1.764
Gatwick Airport Ltd UK ETS emissions	0.010	0.011
Total traded sector emissions	1.834	1.843

15.7. Key Project Parameters

15.7.1 The assessment has been based on the parameters identified within Chapter 5: Project Description.

15.7.2 Table 15.7.1 and Table 15.7.2 below identify the key parameters 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 Chapter 5: Project Description be taken forward in the final design of the Project.

Climate Change Resilience and In-combination Climate Change Impacts Assessments

- 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 Phase for ICCI and CCR: 2024-2037		
Climate change impacts to all receptors and asset groups identified by the topic chapters and set out in Chapter 5: Project Description respectively.	Construction activities would be phased over a period of 14 years, 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 Phase: Design Year for ICCI and CCR: 2038		
Climate change impacts to all receptors identified by the topic chapters and all asset groups identified by the Project Description in Chapter 5.	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 have been 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 have been used in view of the requirement of the NPS for National Networks 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 has not been possible to consider climate projections beyond 2079 because the projected extreme weather data sets in UKCP18 only extend to 2079 and these data sets are considered the most appropriate for assessing CCR issues.

GHG Emissions Assessment

- 15.7.4 The impact being assessed is the emission of GHGs arising from the construction of the Project and the operation of the airport in future years. The impact (ie the emissions) arises from a consistent set of sources, albeit the emissions from each source will vary during the period between 2022 and 2038.

Table 15.7.2: Maximum Design Scenarios

Emissions Activity	Maximum Design Parameters
Construction	Construction of all components of the Project Description delivered in line with the indicative phasing.
Air transport	Maximum passenger throughput of approximately 80.2 million passengers per annum (mppa) by 2047, and 389,000 total aircraft movements per annum by 2047.
Surface access	Surface access for maximum 75.6 mppa by 2038 travelling by the same transport modes/distances as for 2018 baseline. Staff access for maximum 32,000 staff travelling by the same transport modes/distances as for 2018 baseline.
Operation of the airport, building and facilities	Energy use to support 75.6 mppa by 2038 equating to consumption of up to 280 million kWh from gas, electricity and fuels. Increased energy, water, wastewater, and waste generation and management to support 75.6 mppa by 2038.

15.8. Mitigation and Enhancement Measures Adopted as Part of the Project

Climate Change Resilience Assessment

- 15.8.1 Gatwick has policies and procedures in place to minimise the impacts of extreme weather events. These are listed in Table 15.8.1. Any mitigation determined to be subsequently required following preparation of the ES will be listed. No monitoring or enhancement has been identified at this stage; it will be updated as part of the ES.

Table 15.8.1: Mitigation and Enhancement Measures for Climate Change Resilience Assessment

Measures Adopted as Part of the Project	Reason
Mitigation	
Gatwick Adverse Weather Plan: includes all airside operations areas and how they can sustain stable operations in the event of an adverse weather event.	This plan achieves resilience by setting out processes and procedures for different extreme weather events.
Sustainability Statement.	The Sustainability Statement for the Project is currently being developed and will inform the ES. It will include measures to address climate change adaptation and resilience.
Code of Construction Practice (CoCP).	The CoCP will set out best practice construction methods to mitigate potential in-combination climate change impacts from climate change on groundwater receptors (Chapter 10: Ground Conditions).

In-combination Climate Change Impacts Assessment

15.8.2 Mitigation and enhancement measures identified by other environmental disciplines and how they influence the ICCI assessment are presented in Table 15.8.2 below.

Table 15.8.2: Mitigation and Enhancement Measures for In-combination Climate Change Impacts Assessment

Measures Adopted as Part of the Project	Reason
Mitigation	
Code of Construction Practice (CoCP).	The CoCP will set out best practice construction methods to mitigate potential in-combination climate change impacts from climate change on groundwater receptors (Chapter 10: Ground Conditions).
Development of a Vegetation Retention Strategy (See Section 8.8 of Chapter 8: Landscape, Townscape and Visual)	To ensure green infrastructure assets are retained wherever possible and impacts of the character of surrounding landscapes and townscapes are minimised.
Planting woodland, tree, scrub, shrub, wetland, amenity and grassland planting (See Section 8.8 of Chapter 8: Landscape, Townscape and Visual)	Planting proposals will ensure a high-quality environment is created. These proposals will include consideration of climate change by including drought resistant species into the matrix planting options and increase resilience of plants to future drought conditions. This will benefit several environmental topics; Chapter 7: Historic Environment, Chapter 8: Landscape, Townscape and Visual, Chapter 9: Ecology and Nature Conservation, Chapter 16: Socioeconomics.
Preparation of a Landscape and Environmental Management Plan (LEMP)	Build long term climate resilient mitigation into the landscape surrounding Gatwick. Further details to be provided in the ES.

Measures Adopted as Part of the Project	Reason
Creation of new high value habitats (ie wet and dry neutral grasslands and neutral and marshy grassland). Along with creation of new habitat within the newly created mitigation area west 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.
Creation of a new pond designed to provide a high value habitat for aquatic flora, invertebrates and amphibians within a mitigation area.	To provide habitats of conservation interest and also to increase resilience of fauna to possible drought conditions in future.
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	Chapter 10: Ground Conditions recommend 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 will be captured in the CoCP.
Appropriate design of newly installed infrastructure in line with relevant UK and European standards.	To minimise the impact from aggressive ground conditions, damaging newly installed infrastructure, which could also be worsened by flood events. Further details on the design of these assets will be provided in the ES.
Realignment of the River Mole	To create a more natural plan form and improve flow regime increasing the existing capacity of the river (Chapter 11: Water Environment). This mitigation will also increase the resilience of the surrounding area to changing climate and provide additional habitats (Chapter 9: Ecology and Nature Conservation).
Relocation and reconfiguration of Pond A and creation of smaller flood water storage areas included across Catchment A	Chapter 11: Water Environment proposes replacing floodplain, lost from construction of new taxiways, as part of the Project. This will accommodate increased runoff, thus reducing flood risk at the site.
Provision of compensatory flood storage areas at Museum Field, existing Car Park X and East of Gatwick Stream.	To replace lost floodplain storage during construction and reduce flood risk in future.
Surface access arrangement drainage strategy and provision of new airfield syphons	The strategy to include new impermeable areas (road and airfield infrastructure) will reduce additional surface water runoff, thus increasing resilience to extreme weather events in future (Chapter 11: Water Environment, and Chapter 12: Traffic and Transport).
Highway improvement scheme	The design of the highway improvement scheme (Chapter 12: Traffic and Transport) will be developed in line with Environment Agency climate change allowances and account for future climate change.
Construction Traffic Management Plan	To minimise any negative environmental and community impacts including the impacts of extreme weather events.

Measures Adopted as Part of the Project	Reason
Noise Insulation Scheme	This voluntary scheme for qualifying buildings will offer acoustic and ventilation measures to reduce noise impacts. It may also reduce overheating risk to households that sign up to the scheme. See Chapter 14: Noise and Vibration for further details
Soil Management Strategy (Chapter 18: Agriculture and Recreation)	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.
Re-provision of existing public open spaces	The newly designed public space is likely to enhance existing conditions; thus reducing negative effects of extreme events on public behavior and patterns of use place (Chapter 16: Socio-economics).
Monitoring	
Monitoring included in environmental topic chapters of this PEIR	Chapter 9: Ecology and Nature Conservation recommends continual monitoring of species assemblages under changing climate conditions, particularly non-native species, and the condition of water bodies providing wetland habitats. Chapter 11: Water Environment states that Gatwick will continue to monitor the quality of water discharge to ensure that any changing rainfall patterns do not impact the water quality given the increased de-icer loading. Whilst winters are expected to be become warmer on average, cold weather spells will still occur up to and during the middle of this century and are expected to be the same magnitude and intensity as today.
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. Enhancement of existing green infrastructure including hedgerows, woodland, trees, shrubs, wetland and amenity planting will also increase the resilience of landscape receptors to changes in future climate.

GHG Emissions Assessment

- 15.8.3 The Project would incorporate many embedded environmental design measures that would be expected to contribute positively to mitigation of the GHG emissions associated with the Project. The extent of such mitigation activities is not yet confirmed, and the impact of these on GHGs has not been calculated within this PEIR but will be included in the ES as part of the application once their detail has been confirmed. Mitigation measures expected for inclusion in the final ES are set out in Table 15.8.3.
- 15.8.4 The majority of mitigation opportunities through both construction and operation will be reflected in the Carbon and Climate Change Action Plan currently in development, and which it is intended

will be submitted as part of the application for development consent along with the final ES, alongside the Energy Strategy and the Surface Access Strategy.

Table 15.8.3: Mitigation and Enhancement Measures (GHG Emissions)

Measures to be Adopted as Part of the Project for the ES	Reason
Mitigation	
Life cycle considerations in design	<p>Early consideration of design strategies for buildings and infrastructure offer the greatest opportunity to reduce carbon during the full life cycle of the Project. The PEIR has quantified GHG emissions based on typical industry benchmarks for material quantities, constituent materials, and recycled content.</p> <p>Opportunities for material selection, sourcing and design optimisation will be identified during subsequent design stages. The opportunities to identify and implement GHG reductions in construction design and material will be delivered through the Carbon and Climate Change Action Plan.</p>
Low carbon design and performance standards	<p>Low and zero carbon design and performance standards will be applied to new infrastructure, including how renewable energy infrastructure will be incorporated into future designs.</p>
Construction Logistics	<p>Reducing the use of road vehicles for delivery of bulk materials to the Project site, and optimisation of transportation distances, are environmental mitigation measures that provides benefits to several environmental disciplines. The PEIR has typical delivery and construction logistics profiles for the assessment as set out in Appendix 15.4.1.</p> <p>This assumption will be reviewed and if necessary, modelling will be updated should this change in advance of the full ES.</p>
Earthworks Strategy	<p>The earthworks strategy seeks to deliver the optimum balance between cut (excavated) material and fill material. This provides benefits to several environmental disciplines in addition to GHG emissions by reducing transport of waste materials. However, the current GHG assessment for this PEIR has assumed a situation whereby there is inadequate space to store excavated material locally for reuse on the Project, instead assuming that it is all transported off site for disposal. In addition, it is assumed (for this PEIR) that all fill materials are sourced from outside the Project boundary. These assumptions will be reassessed in the ES based on the earthworks' strategy at that point in time. However, these assumptions represent a 'worse case' assessment than the final developed earthworks strategy which will reuse/recycle some cut material.</p>
Construction Plant Usage	<p>The PEIR assessment currently assumes all construction plant is diesel powered and of typical efficiency. On site emissions would be reduced through use of more efficient construction plant and low / zero emission construction plant. Where appropriate grid electricity would be used to power construction</p>

Measures to be Adopted as Part of the Project for the ES	Reason
	plant (where this offers a carbon benefit without compromising other environmental priorities).
Material Selection	The PEIR assumes typical carbon intensity for materials as set out in Appendix 15.4.1. In addition to optimising the cut/fill balance across the Project site boundary, the use of lower impact construction products would be considered alongside environmental impacts across the full life cycle to reduce maintenance/replacement frequency. Opportunities for local sourcing of materials will also be sought to minimise transport impacts.
Aircraft Emissions	Gatwick would provide FEGP for most parked aircraft to minimise the need for use of APUs. In addition Gatwick will seek to achieve other opportunities to reduce fuel use in aircraft on the ground including reduced taxiing (to reduce air conditioning use in aircraft), promotion of single-engine taxiing, and working with airlines to reduce waiting times at the runway holds. Gatwick will also seek to integrate infrastructure to support the transition of airlines to alternative aviation technologies including (where appropriate) for electric aircraft and hydrogen aircraft.
Highway Capacity	Improvements to the highways network around the airport are being made as part of the Project, including a new junction with full grade separation for South Terminal access, a new grade-separated junction for North Terminal to remove A23 westbound traffic from the North Terminal roundabout, and works to the Longbridge roundabout. These improvements would reduce the risk of increased congestion (and associated emissions) arising from increased vehicles.
Surface Access	The PEIR has estimated surface access impacts based on passenger and staff numbers, typical transport distance, and historic modal split. No modal shift has been modelled within the PEIR. It is expected that a range of measures will be implemented to reduce the impacts arising from surface access to the airport by passengers and staff by (for example) increasing the number of passengers arriving by public transport, and encouraging other lower carbon modes of transport for those accessing the airport.
Airport Operations	Gatwick is developing an Energy Strategy to support ongoing reductions in Scope 1 and 2 emissions for airport operations, including the power and energy used on site for buildings (improved performance from building fabric, low energy equipment, and use of on-site renewable energy sources) and operational vehicle fleets and equipment (through efficiency and alternative power sources). Further investment is also planned in directly connected renewable energy supply to the airport.
Airside Operations	Gatwick will continue to implement measures to reduce aircraft emissions on the ground through reduced taxiing and reduced APU use. In the longer-term Gatwick will continue to implement enabling infrastructure for airlines to operate electric and alternative fuelled aircraft and the power and distribution

Measures to be Adopted as Part of the Project for the ES	Reason
	systems to support electric vehicles and ground support equipment, including hydrogen and electric charging systems.
Monitoring	
Emissions Monitoring and Reporting	The airport will continue to carry out annual monitoring and reporting of carbon emissions as total emissions and per passenger, to monitor emissions from the operation of the airport. The monitoring regime for emissions will be set out in the draft Carbon and Climate Change Action Plan to be included within the final ES.
Enhancement	
None at present	At present no enhancement opportunities have been confirmed. In the context of GHG emissions, enhancement would be considered as any measure which would result in the sequestration of carbon (inside or outside the site). There may be potential for enhancement through on site landscaping or off site planting. These are yet to be confirmed for the Project and would be set out in the Carbon and Climate Change Action Plan to be included in the final ES.

15.9. Assessment of Effects

Climate Change Resilience

15.9.1 The full CCR assessment for the construction and operational phases has been presented in Appendix 15.9.1.

Initial Construction Phase: 2024-2029

15.9.2 A summary of the CCR assessment is presented in Table 15.9.1 below.

Table 15.9.1: CCR Assessment for the Construction Phase

Climate Change Hazard	Asset Group	Climate Change Impact	Risk
Increased number of extremely hot days	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.	High
Climate changes in 2020-2039 time period and increased probability of extreme weather events	Construction processes	Disruption or hinderance of construction processes.	High

Further Mitigation

- 15.9.3 To minimise the impacts of heat stress on construction workers during the construction phase, it is recommended that cooling and ventilation systems are included in the design of temporary office buildings that are sufficient to deal with projected climate changes over this period, by using the appropriate guidance from the CIBSE. This would be sufficient to mitigate against the climate conditions projected for the construction period.
- 15.9.4 To minimise disruption or hindrance to construction processes, existing mitigation measures, as set out in the CoCP may need to be enhanced to deal with future climate change impacts. Further mitigation may be proposed, if considered necessary, following any scheme refinements and further assessment as part of the ES.
- 15.9.5 Climate change projections should also be considered in the Code of Construction Practice (CoCP) and any contractor risk assessments developed as part of the construction phase.

Future Monitoring

- 15.9.6 Monitoring of thermal conditions in temporary buildings associated with the construction activities is likely to be sufficient to assess the efficiency of cooling and ventilation systems in temporary buildings when in operation.

Operation

- 15.9.7 The preliminary CCR assessment for the operational period has been presented in Table 15.9.2. The risk classification (column 4 of the table below) is a function of likelihood and consequence as illustrated in Table 15.4.7.

Table 15.9.2: CCR Assessment for the Operational Phase

Climate change Hazard	Asset Group	Climate Change Impact	Risk
Increased number of extremely hot days	Airport Operation	Overheating in terminal buildings, hotels, and other buildings 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.	High
	Airport infrastructure	Changes to takeoff procedures (eg rescheduling flights to take off during cooler times of the day, increasing weight restrictions on flights) or increasing the length of the runway to enable flights to take off under hotter temperature conditions. More information is required to understand the nature of resilience measures better. This impact will be reviewed and developed as part of the next Phase and reported on in the ES.	Medium/High

Climate change Hazard	Asset Group	Climate Change Impact	Risk
	Electronic Equipment	Sensitive electronic equipment and mechanical operating mechanisms may fail to operate correctly due to high temperatures.	Medium
	Flights	Flashpoint of aviation fuel exceeded on hot days, leading to delays in re-fuelling procedures.	Low
		Possible increase in occurrence of days outside the acceptable range of temperatures affecting aircraft and their utilisation schedule, due to air density changes affecting maximum take-off weight capacity.	Medium
Extreme cold weather	Electronic Equipment	Sensitive electronic equipment and mechanical operating mechanisms may fail to operate correctly due to low temperatures or freezing.	Medium
	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
	Airport Operation	Possible negative health implications for passengers and staff, disruption to service operation.	Low
	Airport Infrastructure	Possible increase in number of days outside the normally acceptable range of conditions for heating systems and increased risk of heating, ventilation and air conditioning failure.	Very low
Increased frequency of flooding from river, surface and groundwater sources	Airport Infrastructure	Flooding of infrastructure during operation: inundation of airfield, airport building basements and sub-structures, utility cables/tunnels.	Medium
		Flooding of road infrastructure connecting to the airport during operation: inundation of access roads and railways. Effects of infrastructure interdependencies.	Medium
	Airport Operation	Flooding of electrical equipment and mechanical operating mechanisms.	Medium
Increased risk of drought	Landscaping	Increased drought stress to plants/landscaped areas.	Medium
	Airport Operation	Increased water stress for new buildings (Hotel and office space).	Very high
Extreme wind speeds	Airport Infrastructure	Possible debris on runways and other airport infrastructure causing delays (foreign object debris).	Medium
		Tree fall due to strong winds leading to road and rail disruption.	Medium
		Failure or damage to parts of structure or infrastructure as a result of changes in strong winds and gustiness.	Medium
	Flights	Aircrafts not permitted to take off or land causing delays.	Medium

Climate change Hazard	Asset Group	Climate Change Impact	Risk
Increased risk of lightning strikes.	Airport Infrastructure	Indirect and direct damage to buildings, infrastructure, aircraft, equipment from lightning strikes.	Low
	Flights	Suspension of activities on the ramp by ground handling agents, delaying the service and turnaround times for aircraft and stressing terminal/gatehouses.	Low

Further Mitigation

- 15.9.8 Two climate change impacts have been determined as high or very high risk, which combines likelihood and consequence (see Table 15.4.7). One climate change impact has been determined as medium to high. Recommended mitigation measures to moderate those risks are described below.
- 15.9.9 Embedded mitigation for increased risk of overheating in terminal buildings, hotels, and other buildings has not yet been determined. It is likely that mitigation measures would be implemented to account for current day overheating in buildings. It is recommended that cooling and ventilation systems are included in the design of terminal buildings, hotels and other buildings that are sufficient to deal with projected climate changes over the operational period of the Project, using appropriate guidance from CIBSE. Further mitigation may be proposed, if considered necessary, following detailed design, to ensure climate impacts and climate change in future are embedded into the design.
- 15.9.10 Increased water stress for proposed buildings (hotel and office space) has been assessed to be high. The frequency of drought is likely to increase in future and therefore design of proposed buildings will consider the impact of increased water stress over the lifetime of the Project. Water stress mitigation measures will be considered as part of the next phase of design and assessed as part of the ES.

Future Monitoring

- 15.9.11 No future monitoring has been identified as being necessary at this stage. Monitoring may be proposed, if considered necessary, following any Project refinements and further assessment as part of the ES.

In-combination Climate Change Impacts

Construction

- 15.9.12 Initial consultations have been carried out with authors of the topic chapters to identify potential in-combination climate change impacts. Progress towards the assessment of these impacts for the construction phase is presented in Appendix 15.9.2 and a summary is provided below.
- 15.9.13 Phase 1 identified all potential ICCIs and assessed their likelihood. Only ICCIs considered likely were carried forward to Phase 2 and presented in Appendix 15.9.2, where the consequence and significance of the ICCI was assessed.

- 15.9.14 The initial in-combination climate change impacts assessment indicates that no significant impacts have been identified during the construction phase given the mitigation identified above has been embedded into the Project. The assessment will be reviewed during the next phase of development of the Project design and appropriate further mitigation will be developed, if required, and reported on in the ES.

Further Mitigation

- 15.9.15 Based on the initial assessment of in-combination climate change impacts, no additional mitigation has been identified in this PEIR for the construction phase.

Further Monitoring

- 15.9.16 No future monitoring has been identified as being necessary at this stage. Monitoring may be proposed, if considered necessary, following any scheme refinements and further assessment as part of the ES.

Operation

- 15.9.17 The assessment of potential in-combination climate change impacts for the operational phase is presented in Appendix 15.9.2 and summarised below.

- 15.9.18 The initial ICCI assessment indicates that there are no significant ICCI identified during the operation of the development based on current understanding. The assessment will be reviewed during the next phase of development of the project design and appropriate further mitigation will be developed, if required, and reported on in the ES.

Further Mitigation

- 15.9.19 Based on the initial assessment of in-combination climate change impacts, no additional mitigation has been identified in this PEIR for the operational phase.

Further Monitoring

- 15.9.20 No future monitoring has been identified as being necessary at this stage. Monitoring may be proposed, if considered necessary, following any scheme refinements and further assessment as part of the ES.

GHG Emissions during Construction of the Project

- 15.9.21 Construction of the airport facilities, and changes to the supporting highway network, would result in GHG emissions as shown in Table 15.9.3. This shows emissions from planned construction irrespective of the Project, the total emissions arising from the works brought forward as part of the Project, and the aggregated total of both over the period 2021-2038. These impacts would include the production of GHGs arising from:

- the extraction, processing and manufacturing of construction materials;
- transportation of construction materials;
- energy and fuel use in construction activities;
- transport and disposal of construction waste; and
- surface access by construction staff.

- 15.9.22 The Project construction is projected to finish in 2038.

- 15.9.23 The aggregated estimated emission from construction of the Project between 2023 and 2038 would be 1.610 MtCO₂e¹⁶. This excludes prior planned construction in the period 2021 to 2024 totalling 0.101 MtCO₂e. A full breakdown of emissions is presented in Appendix 15.4.1.
- 15.9.24 In line with IEMA guidance (IEMA, 2017) the increases in emissions over the baseline (in individual years, and in aggregate) are considered significant due to the permanent, cumulative nature of GHG emissions.

Table 15.9.3: Assessment of Construction Effects

Emissions Activity	Total construction emissions (Baseline) (MtCO ₂)	Total construction emissions (the Project) (MtCO ₂)	Aggregated construction emissions (MtCO ₂)
Construction emissions	0.101	1.610	1.711

Contextualising the Emissions

- 15.9.25 The emissions from construction are set out against the UK carbon budgets as shown in Table 15.9.4.

Table 15.9.4: Construction Emissions Comparison with UK Carbon Budgets

Carbon Budget	Period	Five Year Carbon Budget (MtCO ₂ e)	Total Forecast Construction Emissions from the Project in the Five Year Period (MtCO ₂ e) ¹⁷	Contribution to Carbon Budget
3 rd Carbon Budget	2018 to 2022	2,544	0.00018	<0.01%
4 th Carbon Budget	2023 – 2027	1,950	0.765	0.04%
5 th Carbon Budget	2028 – 2032	1,725	0.738	0.04%
6 th Carbon Budget	2033 – 2037	965	0.107	0.01%

Further Mitigation

- 15.9.26 No further mitigation is expected beyond the activities set out in Section 15.8.

Future Monitoring

- 15.9.27 No further monitoring is expected beyond the activities set out in Section 15.8.

¹⁶ Land use change emissions (eg from addition/removal of vegetated areas) have not been calculated for this PEIR. These will be incorporated into the final ES.

¹⁷ Construction emissions in this period are associated with planned construction activities in the Project only. With the inclusion of baseline construction emissions in 2018-22 are 0.083 MtCO₂e, and in 2023-27 are 0.784 MtCO₂e.

¹⁸ Construction emissions in this period are very small but non-zero.

GHG Emissions during Operation of the Project (2029)

Operational Emissions

15.9.28 GHG operational emissions for the first full year of opening in 2029 are presented in Table 15.9.5 below. A full breakdown is provided in Appendix 15.4.1. These operational emissions incorporate both baseline emissions and additional emissions that would occur as a result of the Project, so as to represent the total emissions for Gatwick with the Project in 2029. The aviation emissions reflect changes in the expected aircraft fleet in the period to 2029. The projected emissions do not include any consideration of sustainable aviation fuel (SAF) within the operation of aircraft, or other improvements such as uptake of electrical or hydrogen powered aircraft.

Table 15.9.5: Operational Emissions Assessment for 2029

Emissions activity	Opening year (MtCO ₂)
	2029
Airport operation	0.066
Surface Access	0.393
UK domestic flights	
LTO	0.024
CCD	0.049
Total	0.074*
Non-domestic EEA flights	
LTO	0.254
CCD	1.599
Total	1.854*
Non-EEA International flights	
LTO	0.169
CCD	3.884
Total	4.053
TOTAL	6.440

* Table values do not sum due to rounding

Total GHG Emissions for the Project (2029)

15.9.29 The emissions summary for the opening year 2029 includes operational emissions and construction emissions and is presented in Table 15.9.6.

Table 15.9.6: Emissions Assessment Summary for 2029

Emissions Totals	Opening Year (MtCO ₂)
	2029
Construction emissions for the Project	0.076
Total operational emissions excluding international air transport	0.533
Total operational emissions from international air transport	5.907
Total including international air transport	6.516

15.9.30 The opening year 2029 traded emissions sector emissions are presented in Table 15.9.8. Traded sector emissions are those which fall under the UK ETS. These include domestic and non-domestic intra-EEU aviation emissions, and also a portion of emissions generated by combustion plant owned and operated by Gatwick Airport Ltd. Emissions under EU ETS consider only CO₂ emissions (not the wider CO₂-equivalent emissions).

Table 15.9.7: Opening Year (2029): Traded Sector Emissions

Emissions Totals	Opening Year GHG Emissions (MtCO ₂)
UK domestic flights ^(e)	0.074
Non-domestic EEA flights ^(f)	1.854
Gatwick Airport Ltd UK ETS emissions	0.004
Total traded sector emissions	1.931*

* Table values do not sum due to rounding

Comparison with Baseline

15.9.31 The emissions for 2029, in total, are 0.519 MtCO_{2e} above the 2029 baseline assessment. Of this increase:

- construction emissions in 2029 are predicted to increase from the baseline of zero to 0.076 MtCO_{2e};
- airport operation emissions in 2029 are predicted to reduce from the baseline of 0.071 MtCO_{2e} to 0.066 MtCO_{2e} reflecting the greater opportunity for delivery of lower carbon energy systems arising under the Project scenario;
- surface access emissions in 2029 are predicted to increase from the baseline of 0.368 MtCO_{2e} to 0.393 MtCO_{2e};
- aviation emissions in 2029 are predicted to increase from the baseline of 5.558 MtCO₂ to 5.981 MtCO₂; and
- traded sector emissions in 2029 are predicted to increase from the baseline of 1.835 MtCO_{2e} to 1.931 MtCO_{2e}.

Significance of Effects

15.9.32 In line with IEMA guidance (IEMA, 2017) all emissions are considered significant due to the permanent, cumulative nature of GHG emissions. In line with IEMA guidance the context of these changes in emissions, and their contribution to relevant carbon targets, are discussed in the following sections with reference to Tables 15.9.8 to 15.9.12.

15.9.33 The UK carbon budgets include domestic aviation, but do not include international aviation (see Section 15.2). The comparison below represents the emissions for the Project with the exclusion of international aviation emissions.

Table 15.9.8: Comparison of 2029 Emissions Against UK Carbon Budget

Carbon Budget	Period	Average Annual Carbon Budget (MtCO ₂ e)	Forecast Emissions from the Project for 2029 (MtCO ₂ e)	Contribution to Average Annual Carbon Budget
5 th Carbon Budget	2028 - 32	345	0.609	0.18%

15.9.34 A fuller assessment of increased emissions from aviation, and the relevance to long term carbon targets, is provided later in this chapter. Future GHG emissions will be monitored through the existing annual corporate reporting.

GHG Emissions during Operation of the Project (2038)

Operational Emissions

15.9.35 GHG operational emissions for the design year 2038 are presented in Table 15.9.9 below. A full breakdown is provided in Appendix 15.4.1. These operational emissions incorporate both baseline emissions and the additional emissions that would occur as a result of the Project, so as to represent the total emissions for Gatwick with the Project in 2038. The aviation emissions reflect changes in the expected aircraft fleet in the period to 2038. The projected emissions do not include any consideration of SAF within the operation of aircraft, or other improvements such as uptake of electrical or hydrogen powered aircraft.

Table 15.9.9: Operational Emissions Assessment for 2038

Emissions Activity	Design Year (MtCO ₂)
	2038
Airport operation	0.057
Surface access	0.457
UK domestic flights	
LTO	0.027
CCD	0.053
Total	0.080
Non-domestic EEA flights	
LTO	0.283
CCD	1.832
Total	2.115
Non-EEA international flights	
LTO	0.181
CCD	4.685
Total	4.866
TOTAL	7.575

Total GHG Emissions for the Project (2038)

15.9.36 The emissions summary for the design year 2038 includes operational emissions and construction emissions and is presented in Table 15.9.10.

Table 15.9.10: Emissions Assessment Summary for 2038

Emissions totals	Design year (MtCO ₂)
Construction emissions for the Project	0
Total excluding international air transport	0.594
Total operational emissions from international air transport	6.981
Total including international air transport	7.575

15.9.37 The design year 2038 traded emissions sector emissions are presented in Table 15.9.11. Traded sector emissions are those which fall under the UK ETS. These include domestic and non-domestic intra-EEU aviation emissions, and a portion of emissions generated by combustion plant owned and operated by Gatwick Airport Ltd. Emissions under UK ETS consider only CO₂ emissions (not the wider CO₂-equivalent emissions).

Table 15.9.11: Design Year (2038): Traded Sector Emissions

Emissions Totals	Design Year GHG Emissions (MtCO ₂)
UK domestic flights ^(e)	0.080
Non-domestic EEA flights ^(f)	2.115
Gatwick Airport Ltd UK ETS emissions	0.002
Total traded sector emissions	2.197

* Table values do not sum due to rounding

Comparison with Baseline

15.9.38 The emissions for 2038, in total, are 1.387 MtCO₂e above the 2038 baseline assessment. Of this increase:

- construction emissions in 2038 are zero for both the baseline and the with-Project scenario;
- airport operation emissions in 2038 have reduced from the baseline of 0.061 MtCO₂e to 0.057 MtCO₂e;
- surface access emissions in 2038 have increased from the baseline of 0.382 MtCO₂e to 0.457 MtCO₂e;
- aviation emissions in 2038 have increased from the baseline of 5.746 MtCO₂ to 7.061 MtCO₂; and
- traded sector emissions in 2038 have increased from the baseline of 1.843 MtCO₂e to 2.197 MtCO₂e

Significance of Effects

15.9.39 In line with IEMA guidance (IEMA, 2017) all emissions are considered significant due to the permanent, cumulative nature of GHG emissions. In line with IEMA guidance the context of these changes in emissions, and their contribution to relevant carbon targets, are discussed in the

following section. A fuller assessment of increased emissions from aviation, and the relevance to long term carbon targets, is provided later in this chapter.

- 15.9.40 The UK has not yet adopted carbon budgets for the period beyond 2037, and the carbon budget for the period beyond 2037 is unlikely to be adopted for several years. However, the Sixth Carbon Budget has been confirmed for the period 2033-37 (it now includes international aviation). The annual average budget for this period is 193 MtCO₂e (based on a five-year budget of 965 MtCO₂e). Compared to the last year of the Sixth Carbon Budget (2037) the in-scope emissions (domestic and international) for 2038 are estimated as 7.575 MtCO₂e per year – equivalent to 3.9% of the national emissions target for that year. This includes international aviation.

Further Mitigation

- 15.9.41 No further mitigation is expected beyond the activities set out in Section 15.8.

Future Monitoring

- 15.9.42 No further monitoring is expected beyond the activities set out in Section 15.8.

Worst Case Scenario

- 15.9.43 The Airports NPS requires that a ‘worst case’ scenario is assessed as part of the GHG assessment. Worst case has been interpreted as both the year of highest aggregated emissions, or the year in which emissions differ to the greatest extent from the baseline.
- 15.9.44 The assessment of worst case year for aggregate emissions from all sources (ie maximum emissions in any one year) is presented in Appendix 15.4.1. The worst case year for construction emissions is also set out in Appendix 15.4.1.

Table 15.9.12: Assessment of Worst Case Year Emissions

Emissions source	Worst case year	Emissions (MtCO ₂ e)	Difference from baseline (MtCO ₂ e)
Highest aggregate emissions	2038	7.575	+1.387
Greatest increase over baseline	2032	7.474	+ 1.514
Highest annual construction emissions	2025	0.389	zero baseline

GHG Emissions during Operation of the Project (2047)

- 15.9.45 The GHG assessment has assessed the impact of the Project for 2029 and 2038 to align with other topic assessments with which it shares common modelling (most pertinently the air quality assessment). The GHG has not assessed effects in 2047, but has provided consideration of aviation emissions out to 2050. By this point in time the majority of non-aviation emissions sources are expected to be at or near zero in line with national carbon targets. Aviation is likely to remain one of the sectors with residual emissions by 2050, albeit in the context of a wider net zero economy which relies on offsets and GHG removals to achieve overall Net Zero.

Assessment Against UK Long Term Targets

- 15.9.46 The Airports NPS (Department for Transport, 2018b) (para 5.82) notes that any increase in carbon emissions alone is not a reason to refuse development consent, unless the increase in carbon emissions resulting from the project is so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets, including carbon budgets. The assessment of impact is further informed by other Government documentation including Making Best Use (MBU), and National Planning Policy Framework, and other recent or emerging policy in the TDP (DfT, 2021a) and the Jet Zero consultation (DfT, 2021b). The Jet Zero consultation affirms that MBU and the Airports NPS remain the most up-to-date policy on planning for airport development and continue to have full effect, notwithstanding the need for any increase in airport capacity to be compatible with the UK meeting its climate change obligations.
- 15.9.47 Calculated emissions for 2050 are presented in Table 15.9.13 for both the future baseline, and the future with the Project . This is a projection from the modelled 2038 emissions, scaled to reflect the forecast changes in ATMs for domestic, short and long haul flights.
- these represent scaled emissions from 2038 based on ATM changes;
 - this initial assessment takes no account of expected efficiency changes in aircraft;
 - the initial assessment takes no account of use of SAF; and
 - the initial assessment takes no account of uptake of electric or hydrogen powered aircraft, which are expected to be in operation over the timeframe of the project for some domestic and short haul flights.

Table 15.9.13: Modelling of Future Aviation Emissions for 2050 (no inclusion of efficiency or SAF uptake)

	GHG Emissions 2050 (MtCO ₂) for aviation only
GHG Emissions 2050 (MtCO ₂) without the Project	6.424
GHG Emissions 2050 (MtCO ₂) with the Project	7.512

- 15.9.48 Trajectories for national aviation emissions, and what can be achieved to bring them in line with the Net Zero commitment, have been produced by various bodies including UK Government, CCC, and Sustainable Aviation. Each makes use of a suite of factors to effectively reduce emissions to Net Zero, including:
- fuel efficiency improvements for aircraft at varying degrees and rapidity between now and 2050;
 - use of sustainable aviation fuels at various levels and rate of uptake between now and 2050;
 - use of zero emission aircraft for domestic and short haul flights;
 - carbon pricing impacts; and
 - use of abatement, offsetting and GHG removals to reduce to Net Zero.
- 15.9.49 An illustrative scenario has been modelled whereby the historic rate of engine efficiency adopted by the CCC in their Balanced Pathway model is assumed (1.4% per annum) but only for the period from 2038-2050. Estimates for the benefits of efficiency improvements vary across scenario modelling – this is a conservative estimate within the range used across different scenarios produced by Government, CCC and the aviation industry.

Table 15.9.14: Effect of Engine Efficiency Improvements between 2038 and 2050

	Aviation GHG Emissions in 2050 assuming 1.4% efficiency improvement from 2038-2050 (MtCO₂)	Reduction against counterfactual with zero efficiency improvement
GHG Emissions 2050 (MtCO ₂) without the Project	5.424	15.6%
GHG Emissions 2050 (MtCO ₂) with the Project	6.433	14.4%

- 15.9.50 The Jet Zero consultation reaffirms the Government’s established policy of supporting UK airports making best use of existing runways.
- 15.9.51 The Jet Zero consultation states that growth in the aviation sector in the UK is not incompatible with meeting the UK’s GHG reduction targets. The UK Government considers this can be achieved through a combination of improvement and accelerations in aircraft and airspace technology and efficiency; deployment of sustainable aviation fuels (derived from a range of sources and production routes); development of electric or hydrogen (or hybrid) aircraft especially for domestic or short haul flights; and further net reductions in atmospheric concentration of GHGs through offsets or carbon removals. The consultation acknowledges that the balance of benefits across each of these measures is uncertain, but that in aggregate they are expected to provide a route to Net Zero for the industry. The consultation also notes the need for collaboration between Government, airports, airlines, fuel suppliers and other actors within the aviation industry. It also proposes a five-yearly review of strategy, and notes the potential need for other measures to be introduced depending on progress.
- 15.9.52 The preliminary work for this PEIR has established an upper estimate on emissions for 2050 based on a ‘Do nothing’ scenario – eg where there are no improvements to aircraft, no transition to zero emissions flights, and no uptake of SAF. In reality these mechanisms will reduce sector emissions prior to use of offsetting to achieve Net Zero.
- 15.9.53 At this stage it is not considered that the scale of increased emissions from the Project for 2050 will impact upon the ability of UK to meet its carbon targets given the range of mechanisms whereby emissions can be reduced, and offset, given sufficient progress across Government and industry to deliver the innovation, infrastructure, and supply chains to reduce emissions from aircraft.
- 15.9.54 At the time of producing this PEIR the likely trajectory of the industry to Net Zero, and the impact of different industry mitigation measures to achieve this, are unclear. As the UK Government progresses through the Jet Zero consultation (with a likely decarbonisation trajectory developed for the UK aviation sector as part of this) more detailed analysis on the outturn emissions for 2050 will be enabled. Likely trajectories for future emissions arising from the Project, and the contribution of these to national emissions in the UK, will be presented in the ES.
- 15.9.55 Gatwick has started the work needed to explore and identify further actions needed to support this collective action both as part of current operations and with proposed development. In 2021 Gatwick published the Second Decade of Change policy, for the period to 2030, which includes

commitments to achieve 80% reduction on Scope 1 and 2 emissions by 2030 (against the 1990 baseline), and a longer-term goal to achieve 'net zero' by 2040, and to support the transition of UK aviation and ground transport to net zero.

- 15.9.56 Gatwick is currently developing a detailed Carbon and Climate Change Action Plan, alongside energy and transport strategies, to enable the airport to continue to reduce carbon emissions and to deliver sustainable development. The intention is to publish the draft Action Plan as part of the submission for development consent. The Action Plan will include measures and actions planned by Gatwick to deliver GHG reductions within areas of direct control, and these are set out in the Mitigation section 15.8. The Action Plan will also detail what activity Gatwick can take to contribute to the wider collective industry activity set out in the Jet Zero consultation.

15.10. Cumulative Effects

- 15.10.1 CCR requires consideration of the resilience of the design of an individual project to climate change. Assessment of cumulative effects is not relevant to this element of the chapter.
- 15.10.2 The ICCI assessment is an assessment of the exacerbation of climate change on existing effects. As the climate change projections have been included within each PEIR topic's primary assessment and are therefore carried through to the aspect-specific cumulative effects assessment, a separate climate change cumulative effects assessment is not required.
- 15.10.3 GHG emissions are inherently cumulative for the following reasons:
- the environmental impact arising from GHGs is the aggregation and increased concentration of GHGs within the atmosphere;
 - the location of the emissions source is not relevant to the impact arising from it; any development leading to GHG emissions has the same impact whether it is located near to Gatwick or in another region/country; and
 - the climate change impacts on a given location arise from the aggregated GHG levels in the atmosphere, not from the magnitude of GHG emissions in the local area.
- 15.10.4 Any attempt to compile a cumulative assessment of GHGs would have to include all development projects in the UK (as the impact of GHGs is not related to their emission location) and for this reason the approach for managing the cumulative GHG emissions across the UK is through the adoption of carbon budgets as developed by the CCC and adopted by the UK Government. This GHG assessment has considered whether the Project materially impacts the UK's ability to meet its carbon reduction targets and carbon budgets by 2050. In accordance with IEMA guidance, all GHG emissions are considered significant and considered to contribute to climate change. It is considered that this project would not have a material impact on the ability of the Government to meet its carbon reduction targets, including carbon budgets as they stand at present.

15.11. Inter-Related Effects

- 15.11.1 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.
- 15.11.2 The ICCI assessment reviews the inter-relationships between climate change and all the other environmental topics as set out in the assessment above (Section 15.9).

15.11.3 The assessment of GHG emissions has taken into account data from a range of emissions sources which are related to other environmental topics (eg construction processes, transport impacts, air quality assessment). Beyond these links there are no further inter-related effects between the assessment of GHG emissions arising from the Project and effects on other environmental topics.

15.12. Summary

15.12.1 The CCR assessment identified several risks as being high or very high during the construction and operation phase. Mitigation for these risks is being developed such that the design would be resilient to climate change. With such measures in place, significant effects are not likely.

15.12.2 No significant effects have been identified thus far through the ICCI assessment for the construction or operational phases.

15.12.3 The GHG assessment has assessed the calculated GHG emissions arising from the Project and confirms that these are significant, in line with guidance which considers all net emissions arising from a project as significant. The GHG emissions arising from aviation form the greatest proportion of overall emissions. 2038 emissions from all sources are 7.575 MtCO₂e (including all international aviation) compared with a future baseline projection of 6.188 MtCO₂e in the absence of the Project. This includes an element of fleet turnover affecting aviation emissions, but no inclusion of more widespread decarbonisation mechanisms such as increased efficiency of engines and use of sustainable aviation fuels.

15.12.4 A full assessment of the mitigation opportunities, and quantification of these in terms of GHG emission reduction, has not been carried out for this PEIR. Mitigation will be quantified within the final ES and will comprise mitigation measures as indicated in Table 15.8.3. Mitigation measures are likely to reduce those emissions under most control by Gatwick Airport – namely construction related emissions, and those relating to surface access by passengers and staff. Other mitigation measures will also be quantified for their contribution to reducing the Project emissions from operation of the airport and its buildings.

15.12.5 On the basis of this assessment it is expected that the Project would not have a material impact on the ability of Government to meet its carbon reduction targets, including carbon budgets as they stand at present.

Table 15.12.1: Summary of Effects

Receptor	Receptor Sensitivity	Description of Impact	Short/medium/long term/permanent	Magnitude of Impact	Significance of Effect	Significant/not significant	Notes
Construction Phase							
Project itself and its users (CCR)	N/A	Lack of resilience of assets to extreme weather events (ie flooding or heatwaves)	Medium-long term temporary	Up to high/very high level of risk prior to further design mitigation.	With suitable mitigation in place, likely to be reduced such that effect not significant.	Not significant	Based on current design information for some assets, the magnitude of impact has been designated as very high risk. Suggestions for mitigation as part of design have been provided and further assessment will be completed during the ES when there is a better understanding of the risk profile.
ICCI	N/A	ICCI	Short-term temporary	Minimal	Not significant	Not significant	Based on the current development of mitigation, and the likely progress during the next phase, no significant effects have been identified. Once more detailed mitigation is defined this assessment

Receptor	Receptor Sensitivity	Description of Impact	Short/medium/long term/permanent	Magnitude of Impact	Significance of Effect	Significant/not significant	Notes
							will be reviewed (as part of the ES).
GHG	N/A	Emission of GHGs	Long term	N/A	Significant	Significant	IEMA guidance indicates that all emissions of GHG are significant
Operational Phase							
Project itself and its users (CCR)	N/A	Lack of resilience of assets to future climate change	Permanent (long term)	Very low to very high level of risk prior to further design mitigation.	With suitable mitigation in place, likely to be reduced such that effect not significant.	Not significant	Given limited design information for some assets, the magnitude of impact has been designated as very high risk. Suggestions for mitigation as part of design have been provided and further assessment will be completed during the ES when there is a better understanding of the risk profile
ICCI	N/A	ICCI	Long term	Minimal	Not significant	Not significant	Based on the current development of mitigation, and the likely progress during the next phase, no significant effects have

Receptor	Receptor Sensitivity	Description of Impact	Short/medium/long term/permanent	Magnitude of Impact	Significance of Effect	Significant/not significant	Notes
							been identified. Once more detailed mitigation is defined this assessment will be reviewed (as part of the ES).
GHG (all years)	N/A	Emission of GHGs	Long term	N/A	Significant	Significant	IEMA guidance indicates that all emissions of GHG are significant

15.13. Next Steps

- 15.13.1 Discussions will continue with the design teams as the design of the Project progresses to understand better the risk profile for the receptors where high risks were identified in the CCR assessment. A sensitivity analysis will be undertaken to consider more extreme climate changes and the impact this may have on the resilience of the Project. The preliminary CCR assessment will be updated based on the final Project Description and the findings will be presented in the ES.
- 15.13.2 The ICCI assessment will be updated based on the final assessment from other relevant topics and presented in the ES. This will include a review of the CoCP, a better understanding of the contents of mitigation documents for several disciplines and confirmation of flood risk and drainage design that will be developed for use during the construction phase. Further mitigation may be proposed, if considered necessary, following any scheme refinements and further assessment as part of the ES.
- 15.13.3 The forecast GHG emissions will be reviewed in preparation for the final ES. Specifically, the following will be considered in further detail:
- the scale of aircraft emissions will be reviewed to take into account the likely evolution and use of sustainable aviation fuels, and to reflect expected gradual transition to electric / hybrid aircraft in use on some domestic and short haul routes;
 - more developed data on the design of buildings and infrastructure, and a more informed estimate of the material requirements and waste arisings from the construction of the Project;
 - improved information from the strategic transport modelling to inform the assessments of surface access emissions;
 - confirmation of the mitigation measures to be implemented and their effect on reducing the emissions arising from the Project including benefits of measures in the Carbon and Climate Change Action Plan currently under preparation; and
 - any changes to UK carbon budgets resulting from the revision to the Climate Change Act.
- 15.13.4 Further GHG assessment work will be progressed to assess fully the impact of land use changes within the assessment, and also to include emissions arising from retail freight. However, neither of these are expected to change the emissions forecasts for the Project significantly or the conclusions of the assessment.
- 15.13.5 Next steps will also see close working with the Project design teams to confirm the adoption of mitigation measures through design of the airport facilities and highways infrastructure, optimisation of material sourcing and recycling of cut/fill materials, management of construction stage emission, and the adoption of an energy strategy to reduce emissions arising from airport operations. The opportunities to mitigate impacts of the Project through both construction and operation will be collated into the draft Carbon and Climate Change Action Plan to support the submission for development consent. The ES will seek to quantify the GHG impacts of mitigation measures in the final ES.

15.14. References

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15.15. Glossary

Table 15.15.1: Glossary of Terms

Term	Description
AEED	Aircraft Engine Emissions Databank
ANPS	Airports National Policy Statement
APU	Auxiliary Power Units
ATM	Air Traffic Movement
AWP	Adverse Weather Plan
BEIS	Department for Business, Energy and Industrial Strategy

Term	Description
BSI	British Standards Institute
CAA	Civil Aviation Authority
CCAR	Climate Change Adaptation Report
CCC	Committee on Climate Change
CCD	Climb-Cruise-Descent
CCR	Climate Change Resilience
CCRA	Climate Change Risk Assessment
CEA	Cumulative Effects Assessment
CIBSE	Chartered Institute of Building Services Engineers
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CO _{2e}	Carbon Dioxide equivalent
DCO	Development Consent Order
DEFRA	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
EEA	European Economic Area
EIA	Environmental Impact Assessment
ES	Environmental Statement
EU ETS	European Union Emission Trading Scheme
FEGP	Fixed Electrical Ground Power
FRA	Flood Risk Assessment
GAL	Gatwick Airport Limited
GHG	Greenhouse Gas
GPU	Ground Power Units
GSE	Ground Support Equipment
ICAO	International Civil Aviation Organization
ICCI	In-combination Climate Change Impacts
IEMA	Institute of Environmental Management and Assessment
IPCC	Intergovernmental Panel on Climate Change
LTO	Landing and Take-off
MBU	Making Best Use
N ₂ O	Nitrous Oxide
NAP	National Adaptation Programme
NDC	Nationally Determined Contribution
NN NPS	National Networks National Policy Statement
NO _x	Oxides of Nitrogen
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NPS	National Policy Statement
PEIR	Preliminary Environmental Information Report
PSO	Public Service Obligation
RCP	Representative Concentration Pathway

Term	Description
RF	Radiative Forcing
RICS	Royal Institution of Chartered Surveyors
SAF	Sustainable Aviation Fuel
SF ₆	Sulphur Hexafluoride
SoS	Secretary of State
TDP	Transport Decarbonisation Plan
UKCP	UK Climate Projections
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council for Sustainable
WRI	World Resources Institute
ZEF	Zero Emission Flight
ZoI	Zone of Influence